

**EPA Superfund
Record of Decision:**

**BOWERS LANDFILL
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OU 01
CIRCLEVILLE, OH
03/31/1989**

LONG-TERM GROUND-WATER MONITORING; SITE RESTRICTIONS AND A PERIMETER FENCE TO LIMIT SITE ACCESS AND USE; REMOVAL OF DEBRIS AND VEGETATION FROM THE LANDFILL SURFACE; PLACEMENT OF A LOW-PERMEABILITY CLAY CAP (CONSISTING OF A CLAY LAYER, TOPSOIL LAYER, AND VEGETATION) OVER THE ENTIRE LANDFILL SURFACE; DRAINAGE IMPROVEMENTS TO CONVEY RAINFALL AND FLOOD WATERS AWAY FROM THE LANDFILL; AND EROSION AND FLOOD CONTROL MEASURES ON AREAS OF THE LANDFILL SUBJECT TO DAMAGE FROM FLOOD WATERS.

#DA

8.0 DESCRIPTION OF ALTERNATIVES

IN RESPONSE TO THE FINDINGS OF THE EA, THE FS IDENTIFIED THREE POTENTIAL RISKS THAT SHOULD BE ADDRESSED BY REMEDIAL ACTIONS AT BOWERS LANDFILL. THESE RISKS ARE ASSOCIATED WITH INGESTION OF GROUND WASTER IMMEDIATELY DOWNGRAIDENT OF THE LANDFILL, INGESTION OF SOIL FROM THE LANDFILL, AND FUTURE RELEASES FROM THE LANDFILL.

THE FS IDENTIFIED TECHNOLOGIES THAT COULD REDUCE RISKS FOR EACH OF THESE MEDIA. THESE TECHNOLOGIES WERE ASSEMBLED INTO MEDIA-SPECIFIC REMEDIAL ALTERNATIVES. THE FS THEN SCREENED THESE MEDIA-SPECIFIC ALTERNATIVES BASED ON EFFECTIVENESS IN REDUCING RISKS, IMPLEMENTABILITY, AND COST. MEDIA-SPECIFIC ALTERNATIVES REMAINING AFTER THE SCREENING PROCESS WERE ASSEMBLED INTO NINE SITE-WIDE REMEDIAL ALTERNATIVES FOR DETAILED EVALUATION. THIS SCREENING PROCESS WAS CARRIED OUT ACCORDING TO PROCEDURES SPECIFIED BY US EPA IN CERCLA, THE NCP, AND US EPA GUIDANCE DOCUMENTS INCLUDING "INTERIM GUIDANCE ON SUPERFUND SELECTION OF REMEDY" (OSWER DIRECTIVE NO. 9355.0-19, DECEMBER 24, 1986) AND "DRAFT GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATION AND FEASIBILITY STUDIES UNDER CERCLA" (OSWER DIRECTIVE NO. 9355.3-01, MARCH 1988).

THE ALTERNATIVES EVALUATED IN DETAIL INCLUDE A NO ACTION ALTERNATIVE AND EIGHT ALTERNATIVES THAT RELY ON CONTAINMENT OF WASTE, WITH LITTLE OR NO TREATMENT, TO REDUCE SITE RISKS. THE FS LOOKED AT ALTERNATIVES INVOLVING TREATMENT AS A PRINCIPAL ELEMENT TO REDUCE THE TOXICITY, MOBILITY, OR VOLUME OF SITE WASTES. HOWEVER, THESE ALTERNATIVES WERE SCREENED OUT, BASED ON IMPLEMENTABILITY, PRIOR TO THE DETAILED ANALYSIS. THE FS DID NOT DEVELOP ANY REMEDIAL ALTERNATIVES FOR SOURCE CONTROL THAT WOULD ELIMINATE THE NEED FOR LONG-TERM MANAGEMENT, INCLUDING MONITORING. TREATMENT ALTERNATIVES OF THIS TYPE WERE NOT CONSIDERED FEASIBLE BECAUSE OF THE LARGE VOLUME AND DIVERSE NATURE OF THE WASTE MATERIALS IN BOWERS LANDFILL.

EACH OF THE NINE REMEDIAL ALTERNATIVES EVALUATED IN DETAIL IS DESCRIBED BRIEFLY BELOW. THE DESCRIPTIONS INCLUDE CONTAINMENT COMPONENTS, INSTITUTIONAL CONTROLS, ESTIMATED TIME FOR IMPLEMENTATION, COST, OVERALL PROTECTION, AND COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS). SECTION 9.0, WHICH DESCRIBES THE COMPARATIVE ANALYSIS OF ALTERNATIVES, INCLUDES ADDITIONAL DETAIL ON THESE SUBJECTS.

8.1 ALTERNATIVE 1

ALTERNATIVE 1 IS THE NO ACTION ALTERNATIVE. CERCLA REQUIRES THAT THE NO ACTION ALTERNATIVE BE CONSIDERED AT EVERY SITE. UNDER THIS ALTERNATIVE, NO FURTHER ACTION WOULD BE TAKEN AT BOWERS LANDFILL TO REDUCE RISKS OR TO CONTROL THE SOURCES AND MIGRATION OF CONTAMINANTS. THE NO ACTION ALTERNATIVE WILL NOT MODIFY THE LANDFILL IN ANY WAY. THUS, IT HAS NO ASSOCIATED COSTS, AND NO TIME WOULD BE REQUIRED TO IMPLEMENT THIS ALTERNATIVE.

CAPITAL COST:	\$0
PRESENT WORTH OPERATION & MAINTENANCE (O & M) COSTS:	\$0
TOTAL COSTS:	\$0
TIME TO IMPLEMENT:	NONE

8.2 ALTERNATIVE 2

ALTERNATIVE 2 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS

UNDER ALTERNATIVE 2, A LONG-TERM MONITORING PROGRAM WOULD BE IMPLEMENTED TO MONITOR CONTAMINANT CONCENTRATIONS AND MIGRATION. THIS PROGRAM WOULD INCLUDE THE INSTALLATION OF ADDITIONAL MONITORING WELLS SOUTH OF BOWERS LANDFILL (BETWEEN THE LANDFILL AND THE CIRCLEVILLE MUNICIPAL WELLFIELD) AND WEST OF THE

LANDFILL (BETWEEN THE LANDFILL AND THE SCIOTO RIVER). THESE NEW WELLS, EXISTING MONITORING WELLS, AND POSSIBLY RESIDENTIAL WELLS NEAR THE LANDFILL WOULD BE SAMPLED. THE MONITORING PROGRAM WOULD BE DESIGNED TO PROTECT THE SCIOTO RIVER BY SAMPLING GROUND WATER THAT DISCHARGES TO THE RIVER. ADDITIONALLY, THE PROGRAM WOULD SAMPLE WATER FROM THE UPPER AND LOWER AQUIFERS THAT MAY FLOW UNDER THE RIVER AND JOIN REGIONAL GROUND-WATER FLOW. AT A MINIMUM, THE PROGRAM WOULD MEET THE SUBSTANTIVE REQUIREMENTS OF GROUND-WATER MONITORING UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) AS DESCRIBED IN 40 CFR 264, SUBPART F.

THE INSTALLATION OF THREE ADDITIONAL GROUND-WATER MONITORING WELL CLUSTERS IS NECESSARY TO DEVELOP A GROUND-WATER MONITORING PROGRAM THAT WOULD ADEQUATELY DETECT POTENTIAL FUTURE RELEASES OF CONTAMINANTS. THESE WELL CLUSTERS WOULD CONSIST OF THREE WELLS; A SHALLOW WELL THAT WOULD BE LOCATED IN THE UPPER PORTION OF THE SATURATED ALLUVIAL AQUIFER, AN INTERMEDIATE WELL THAT WOULD BE LOCATED BETWEEN THE WATER TABLE AND THE BEDROCK, AND A DEEP WELL THAT WOULD BE LOCATED JUST ABOVE THE BEDROCK. TWO OF THESE WELL CLUSTERS WOULD BE INSTALLED WEST OF THE LANDFILL. ONE CLUSTER WOULD BE INSTALLED BETWEEN WELL LOCATION 5 AND WELL LOCATION 6 AND THE OTHER BETWEEN WELL W-10 AND THE BEND OF THE LANDFILL (SEE FIGURE 3). THE THIRD WELL CLUSTER WOULD BE INSTALLED OFF-SITE BETWEEN THE LANDFILL AND THE CIRCLEVILLE MUNICIPAL WELLFIELD. THE INSTALLATION OF WELL CLUSTERS IN ADDITION TO THESE MAY ALSO BE CONSIDERED.

THE MONITORING WELLS WOULD BE SAMPLED ON A BIMONTHLY BASIS FOR THE FIRST YEAR AND QUARTERLY FOR YEARS 2 THROUGH 4. DURING THE FIRST YEAR, SAMPLES WOULD BE ANALYZED FOR THE FULL TARGET COMPOUND LIST (TCL). A REDUCED TCL MAY BE CONSIDERED AFTER THE FIRST YEAR. IF THE LEVELS OF CONTAMINANTS IN GROUND WATER DID NOT INCREASE OVER THIS TIME PERIOD, THE SAMPLING SCHEDULE WOULD BE REEVALUATED AND A REDUCTION IN THE FREQUENCY OF SAMPLING MAY BE CONSIDERED. A STATISTICAL TEST WOULD BE DEVELOPED TO DETERMINE WHEN A SIGNIFICANT INCREASE IN THE LEVEL OF CONTAMINANTS HAD OCCURRED.

SHOULD A SIGNIFICANT INCREASE IN THE LEVELS OF CONTAMINANTS OCCUR, IT WOULD AUTOMATICALLY TRIGGER A RCRA CORRECTIVE ACTION. IF THE LEVELS OF CONTAMINANTS IN GROUND WATER EXCEEDED MCLS, WHERE AVAILABLE, OR HEALTH-BASED LEVELS, WHERE MCLS ARE NOT AVAILABLE, RESAMPLING WOULD OCCUR WITHIN 14 DAYS. (HEALTH-BASED LEVELS ARE CONCENTRATIONS CORRESPONDING TO A CANCER RISK OF 10-6 FOR CARCINOGENIC CONTAMINANTS AND A HAZARD INDEX (HI) GREATER THAN 1 FOR NONCARCINOGENIC CONTAMINANTS.) IF THE RESAMPLING VERIFIED THAT THERE HAD BEEN A SIGNIFICANT INCREASE IN THE LEVELS OF CONTAMINANTS, A CORRECTIVE ACTION PROGRAM WOULD BE IMPLEMENTED. CORRECTIVE ACTION MAY INCLUDE SUCH MEASURES AS THE ESTABLISHMENT OF ALTERNATE CONCENTRATION LIMITS (ACLs), THE COLLECTION AND TREATMENT OF GROUND WATER, OR THE REMOVAL OF THE SOURCE OF CONTAMINATION.

THE SURFACE WATER IN THE DRAINAGE DITCH TO THE EAST OF THE LANDFILL WOULD BE SAMPLED ON A QUARTERLY BASIS AS PART OF THE MONITORING PROGRAM. MONITORING WOULD VERIFY THAT DISCHARGES FROM THE DITCH ARE IN COMPLIANCE WITH OHIO WATER QUALITY STANDARDS, AS DESCRIBED IN THE OHIO ADMINISTRATIVE CODE (OAC) 3745-01. A CORRECTIVE ACTION PROGRAM WOULD BE IMPLEMENTED IF CONTAMINANT LEVELS IN THE DITCH EXCEEDED THESE STANDARDS.

EFFORTS WILL BE MADE TO PROCURE DEED RESTRICTIONS PROHIBITING GROUND-WATER EXTRACTION IN THE FIELD WEST OF THE LANDFILL AND RESTRICTING DISTURBANCE OF THE LANDFILL SURFACE. THE VIABILITY OF CONTINUED FARMING IMMEDIATELY WEST OF THE LANDFILL WOULD BE EVALUATED, AND, IF SHOWN TO BE NECESSARY, EFFORTS WOULD BE MADE TO PROHIBIT SUCH FARMING BY IMPOSITION OF DEED RESTRICTIONS. A 6-FOOT FENCE WOULD BE PLACED AROUND THE LANDFILL, THE DRAINAGE DITCH TO THE EAST, AND THE FIELD TO THE WEST TO LIMIT SITE ACCESS.

ALTERNATIVE 2 RELIES ENTIRELY ON INSTITUTIONAL CONTROLS AND MONITORING TO REDUCE RISK AND DOES NOT INCLUDE ANY CONTAINMENT OR TREATMENT COMPONENTS. RESTRICTING GROUND-WATER USE IMMEDIATELY DOWNGRADIENT OF THE SITE SHOULD BE EFFECTIVE IN ELIMINATING RISKS FROM DRINKING THIS GROUND WATER. HOWEVER, WHILE FENCING IS IDENTIFIED AS A MEANS FOR LIMITING EXPOSURE, CONTAMINATED SOILS WOULD REMAIN UNCOVERED. EXPOSURE COULD STILL OCCUR THROUGH DISPERSAL OF SOIL BY EROSION AND BY DIRECT CONTACT IF PERSONS ENTER THE SITE DESPITE THE FENCE. POTENTIAL FUTURE RISKS, AS DESCRIBED IN SECTION 6.3, WOULD NOT BE REDUCED. FURTHER, ALTERNATIVE 2 DOES NOT MEET STATE OF OHIO CLOSURE REQUIREMENTS FOR SOLID WASTE LANDFILLS, WHICH HAS BEEN IDENTIFIED AS AN ARAR.

THE COSTS OF ALTERNATIVE 2 AND THE ESTIMATED TIME FOR IMPLEMENTATION ARE AS FOLLOWS:

CAPITAL COST:	\$173,700
PRESENT WORTH O & M COSTS	\$295,100
TOTAL COSTS:	\$468,800

TIME TO IMPLEMENT

1 MONTH

8.3 ALTERNATIVE 3

ALTERNATIVE 3 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * LOCAL REPAIRS TO EXISTING LANDFILL COVER
- * EROSION CONTROL AND DRAINAGE IMPROVEMENTS

ALTERNATIVE 3 INCORPORATES GROUND-WATER MONITORING AND SITE RESTRICTIONS ALREADY DESCRIBED UNDER ALTERNATIVE 2. THE ADDITIONAL COMPONENTS OF THIS REMEDIAL ALTERNATIVE ARE DISCUSSED BELOW.

THE LANDFILL AREA AND ITS IMMEDIATE VICINITY WOULD BE CLEARED OF SURFACE DEBRIS. NONHAZARDOUS DEBRIS WOULD BE DISPOSED OF AT A NEARBY SANITARY LANDFILL, AND ANY WASTE ITEMS DETERMINED TO BE HAZARDOUS WOULD BE DISPOSED OF AT A SUITABLE HAZARDOUS WASTE LANDFILL.

AFTER SURFACE DEBRIS HAS BEEN REMOVED, AREAS SHOWING SIGNS OF EROSION WOULD BE IDENTIFIED. THESE AREAS WOULD BE CLEARED OF VEGETATION AND REPAIRED WITH NATURAL CLAY SOIL TO BE UNIFORM WITH THE SURROUNDING SURFACE. DRAINAGE PATTERNS ON THE LANDFILL WOULD BE SURVEYED, AND AREAS SHOWING EROSION WOULD BE REPAIRED WITH FILL. AREAS PRONE TO PONDING WOULD BE REGARDED TO PROVIDE A UNIFORMLY SLOPING SURFACE THAT WOULD DRAIN WATER OFF THE LANDFILL. THE EXISTING VEGETATION COVER OF TREES ON THE LANDFILL WOULD BE MAINTAINED. AS PART OF THE MAINTENANCE PROGRAM, THE COVER WOULD BE INSPECTED ON A REGULAR BASIS FOR STRUCTURAL INTEGRITY AND VEGETATIVE GROWTH.

THE DRAINAGE DITCH EAST OF THE LANDFILL WOULD BE IMPROVED TO ALLOW WATER TO DRAIN FROM THE FIELD NORTH OF THE LANDFILL THROUGH THIS DITCH. THE PIPE THAT RUNS UNDER THE SOUTHERN END OF THE LANDFILL FROM THIS DITCH WOULD BE REPLACED BY 36-INCH-DIAMETER CORRUGATED METAL PIPE.

EROSION PROTECTION WOULD BE PROVIDED ON THOSE LANDFILL AREAS PRONE TO EROSION DUE TO SWIFT-FLOWING WATER FROM THE RIVER. THIS PROTECTION WOULD INCLUDE ARMOR STONE (RIPRAP) IN AREAS THAT ABUT THE RIVER. STONE WOULD ALSO BE PLACED ON THE NORTH-FACING SLOPE OF THE WESTERN EDGE OF THE LANDFILL AND AT THE SOUTHERN EDGE OF THE LANDFILL TO DISSIPATE THE ENERGY OF RIVER FLOW.

ALTERNATIVE 3 ADDRESSES SOME CONTAINMENT ASPECTS FOR CONTAMINATED SOILS BY PROVIDING LIMITED REPAIRS TO THE EXISTING LANDFILL COVER. HOWEVER, SINCE REPAIRS WOULD BE MADE ON A VISUAL BASIS, THIS ALTERNATIVE CANNOT ENSURE THAT ALL AREAS OF CONTAMINATED SOIL WOULD BE COVERED. THE LANDFILL WOULD REMAIN LARGELY UNCHANGED AND SUSCEPTIBLE TO EROSION AND INFILTRATION OF PRECIPITATION AND SURFACE WATER DURING FLOOD EVENTS. TREES WOULD NOT BE REMOVED FROM THE LANDFILL SURFACE, FURTHER INCREASING THE POTENTIAL FOR INFILTRATION. AS NOTED FOR ALTERNATIVE 2, THIS ALTERNATIVE DOES NOT ADDRESS OHIO CLOSURE REQUIREMENTS FOR SOLID WASTE LANDFILLS.

THE COSTS OF ALTERNATIVE 3 AND THE ESTIMATED TIME TO IMPLEMENT THIS ALTERNATIVE ARE:

CAPITAL COST:	\$1,427,300
PRESENT WORTH O&M COSTS:	\$741,000
TOTAL COSTS:	\$2,168,300
TIME TO IMPLEMENT:	3 MONTHS

8.4 ALTERNATIVE 4

ALTERNATIVE 4 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * NATURAL CLAY COVER OVER LANDFILL
- * EROSION CONTROL AND DRAINAGE IMPROVEMENTS

ALTERNATIVE 4 CONTAINS THE SAME RESTRICTIONS AS DESCRIBED FOR ALTERNATIVE 2. IN ADDITION, THE GROUND-WATER MONITORING PROGRAM WOULD BE IDENTICAL TO THE PROGRAM DESCRIBED UNDER ALTERNATIVE 2. EROSION AND DRAINAGE CONTROL IMPROVEMENTS WOULD BE SIMILAR TO THOSE DESCRIBED FOR ALTERNATIVE 3. HOWEVER, INSTEAD OF LIMITED REPAIRS TO THE LANDFILL COVER, ALTERNATIVE 4 INCLUDES A CLAY COVER OVER THE ENTIRE LANDFILL SURFACE. ALL TREES AND OTHER VEGETATION WOULD BE CUT DOWN TO THE SURFACE, AND STEPS WOULD BE TAKEN TO PREVENT THEIR GROWTH THROUGH THE NEW COVER. PRECAUTIONS WOULD BE TAKEN TO MINIMIZE EXPOSURE OF BURIED WASTE DURING REMOVAL OF VEGETATION.

THE NEW COVER WOULD CONSIST OF A WELL-COMPACTED, LOW-PERMEABILITY CLAY COVER AT LEAST 24 INCHES THICK. A TOP SOIL LAYER AT LEAST 24 INCHES THICK WOULD BE PLACED OVER THE CLAY COVER. THIS TOP SOIL WOULD BE PLANTED WITH GRASSES OR OTHER SHALLOW-ROOTED PLANT SPECIES. THE COVER WOULD EXCEED OHIO CLOSURE REQUIREMENTS FOR SOLID WASTE LANDFILLS, WHICH CALL FOR ONLY A WELL-COMPACTED 24-INCH COVER OF SUITABLE MATERIAL. THE CLAY LAYER WOULD HAVE A MAXIMUM PERMEABILITY OF 10⁻⁷ CM/SEC AND WOULD LIMIT INFILTRATION TO LESS THAN 10 PERCENT OF PRECIPITATION.

PRIOR TO COVER INSTALLATION, A DETAILED GEOTECHNICAL INVESTIGATION WOULD BE CONDUCTED TO MEASURE THE PROPERTIES OF THE SOIL AND CLAY USED TO CONSTRUCT THE COVER. THE PURPOSE OF THIS INVESTIGATION WOULD BE TO DETERMINE THE STABILITY OF THESE MATERIALS UNDER FLOOD CONDITIONS. THE COVER WOULD THEN BE CONSTRUCTED WITH SIDE SLOPES FLAT ENOUGH TO PROTECT THE LANDFILL FROM DAMAGE DUE TO FLOODING. CONSTRUCTION WOULD BE DONE IN SUCH A MANNER AS TO MINIMIZE POTENTIAL HARM TO THE FLOODPLAIN, AS REQUIRED BY 40 CFR 6, APPENDIX A, STATEMENT OF PROCEDURES ON FLOODPLAIN MANAGEMENT AND WETLANDS PROTECTION. IN ADDITION, THE CAP WOULD BE CONSTRUCTED, OPERATED, AND MAINTAINED TO PREVENT WASHOUT OF ANY HAZARDOUS WASTES BY A 100-YEAR FLOOD, AS REQUIRED BY RCRA GENERAL FACILITY STANDARDS IN 40 CFR 264.18. THESE REGULATIONS HAVE BEEN IDENTIFIED AS A LOCATION-SPECIFIC ARARS.

THE CAP AND FENCE WOULD BE INSPECTED ON A QUARTERLY BASIS AND REPAIRS OF ANY SIGNIFICANT DAMAGE WOULD BEGIN WITHIN 30 DAYS. THE LANDFILL WOULD ALSO BE INSPECTED FOR LEACHATE AND METHANE GAS PRODUCTION ON A QUARTERLY BASIS. IF LEACHATE PRODUCTION OCCURRED THAT COULD POTENTIALLY ADVERSELY AFFECT PUBLIC HEALTH OR THE ENVIRONMENT, A LEACHATE COLLECTION SYSTEM WOULD BE INSTALLED AND THE LEACHATE WOULD BE COLLECTED AND TREATED. IF METHANE GAS PRODUCTION OCCURRED THAT COULD POTENTIALLY ADVERSELY AFFECT PUBLIC HEALTH OR THE ENVIRONMENT, A GAS VENTING SYSTEM WOULD BE INSTALLED.

THE DRAINAGE DITCH ADJACENT TO THE EAST SIDE OF THE LANDFILL WOULD BE IMPROVED BY REMOVING SEDIMENTS AS NECESSARY. THE PIPE THAT RUNS UNDER THE LANDFILL FROM THE SOUTHERN END OF THE DITCH WOULD BE REPLACED BY A 36-INCH-DIAMETER CORRUGATED METAL PIPE. THESE IMPROVEMENTS WOULD ALLOW WATER TO DRAIN FROM THE FIELD NORTH OF THE LANDFILL THROUGH THE DITCH AND INTO THE SCIOTO RIVER. DURING THE DESIGN OF THIS ALTERNATIVE, THE FEASIBILITY OF REMOVING CONTAMINATED SEDIMENTS FROM THE DRAINAGE DITCH WOULD BE EVALUATED. THESE SEDIMENTS COULD BE DEWATERED AS NECESSARY AND PLACED ON THE LANDFILL SURFACE PRIOR TO INSTALLING THE CLAY CAP. THE DRAINAGE DITCH, WHICH IS CONTIGUOUS WITH THE EASTERN SIDE SLOPE OF THE LANDFILL, CAN BE CONSIDERED PART OF THE LANDFILL. THEREFORE, MOVEMENT OF SEDIMENTS FROM THE DITCH TO THE LANDFILL WOULD CONSOLIDATE HAZARDOUS WASTES WITHIN A SINGLE DISPOSAL UNIT. THIS WOULD NOT CONSTITUTE "LAND DISPOSAL" UNDER RCRA SUBTITLE C, SO RCRA LAND DISPOSAL RESTRICTIONS IN 40 CFR 268 WOULD NOT BE ARARS. SEDIMENT REMOVAL, IN CONJUNCTION WITH CAPPING, WOULD REDUCE THE POSSIBILITY OF CONTAMINATED SURFACE WATER DISCHARGES FROM THE DITCH TO THE SCIOTO RIVER.

ALTERNATIVE 4 USES SITE RESTRICTIONS TO REDUCE RISKS FROM INGESTION OF GROUND WATER. SOIL INGESTION RISKS WOULD BE GREATLY REDUCED BECAUSE THE ENTIRE LANDFILL SURFACE, WHERE HIGHEST SOIL CONTAMINATION LEVELS WERE

FOUND, WOULD BE COVERED. LONG-TERM RISKS WOULD BE REDUCED BY THE APPLICATION OF A COVER THAT REDUCES INFILTRATION THROUGH THE LANDFILL.

THE COSTS AND TIME TO IMPLEMENT ALTERNATIVE 4 ARE LISTED BELOW:

CAPITAL COST:	\$3,173,000
PRESENT WORTH O&M COSTS:	\$1,094,500
TOTAL COSTS:	\$4,267,500
TIME TO IMPLEMENT:	10 MONTHS

8.5 ALTERNATIVE 5

ALTERNATIVE 5 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * NATURAL CLAY COVER OVER LANDFILL
- * EROSION CONTROL AND DRAINAGE IMPROVEMENTS
- * GAS VENTING SYSTEM

ALTERNATIVE 5 IS IDENTICAL TO ALTERNATIVE 4, EXCEPT THAT THE LANDFILL COVER WOULD INCORPORATE GAS VENTING AND LEACHATE COLLECTION SYSTEMS. THE GAS VENTING SYSTEM WOULD CONSIST OF A NETWORK OF PERFORATED PIPE, APPROXIMATELY 6 INCHES IN DIAMETER, LAID AT 100-FOOT INTERVALS IN A 12-INCH LAYER OF GRAVEL OVER THE LANDFILL SURFACE. THE GRAVEL LAYER WOULD HAVE A GEOTEXTILE FABRIC PLACED OVER THE TOP TO PREVENT SPACES IN THE GRAVEL LAYER FROM CLOGGING. A 24-INCH CLAY COVER WOULD BE PLACED OVER THE GRAVEL LAYER, FOLLOWED BY A 24-INCH SOIL AND VEGETATION COVER. GAS VENTING WOULD CONNECT TO THE PERFORATED PIPE AND EXIT VERTICALLY THROUGH THE CLAY AND SOIL COVERS. GASES CONTAINING HIGH CONCENTRATIONS OF VOCs COULD BE PASSED THROUGH A VAPOR PHASE CARBON ADSORPTION SYSTEM TO REMOVE THESE CONTAMINANTS.

THE LEACHATE COLLECTION SYSTEM, LOCATED AT THE TOE OF THE LANDFILL, WOULD CONSIST OF A PERFORATED PVC PIPE IN A TRENCH FILLED WITH GRANULAR DRAINAGE MATERIAL. THE PIPE WOULD CATCH AND DIRECT LEACHATE TO A COLLECTION POINT. FROM THERE, THE LEACHATE WOULD BE PUMPED TO A TEMPORARY HOLDING TANK, TREATED, AND DISCHARGED.

ALTERNATIVE 5 WOULD PROVIDE SLIGHTLY GREATER PROTECTION THAN ALTERNATIVE 4 BECAUSE OF THE ADDED LEACHATE AND GAS COLLECTION SYSTEMS. IT WOULD ALSO COMPLY WITH ARARS AND WOULD EXCEED OHIO SOLID WASTE LANDFILL CLOSURE REQUIREMENTS.

THE COSTS AND TIME TO IMPLEMENT ALTERNATIVE 5 ARE AS FOLLOWS:

CAPITAL COSTS:	\$4,341,200
PRESENT WORTH O&M COSTS:	\$2,374,600
TOTAL COSTS:	\$6,715,800
TIME TO IMPLEMENT	10 MONTHS

8.6 ALTERNATIVE 6

ALTERNATIVE 6 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * NATURAL CLAY COVER OVER LANDFILL
- * DRAINAGE IMPROVEMENTS
- * LEACHATE COLLECTION SYSTEM
- * GAS VENTING SYSTEM
- * FLOOD PROTECTION DIKE

ALTERNATIVE 6 IS IDENTICAL TO ALTERNATIVE 5, EXCEPT THAT ADDITIONAL FLOOD PROTECTION WOULD BE PROVIDED BY CONSTRUCTING A FLOOD PROTECTION DIKE. THE DIKE WOULD EXTEND AROUND THE WEST AND NORTH SIDES OF THE LANDFILL. A CONCRETE WALL WOULD BE CONSTRUCTED AT THE SOUTH AND NORTHWEST CORNERS OF THE LANDFILL, WHERE THERE IS INSUFFICIENT SPACE FOR A DIKE BETWEEN THE LANDFILL AND THE RIVER. THE CORE OF THE FLOOD DIKE WOULD BE CONSTRUCTED OF AN IMPERVIOUS CLAY MATERIAL, AND THE SIDE SLOPES WOULD BE CONSTRUCTED FROM CLEAN SOIL. THE SIDES OF THE DIKE ALONG THE RIVER WOULD BE PROTECTED AGAINST SURFACE WATER EROSION BY CONCRETE RIPRAP OR ROCK FILL. STORMWATER WITHIN THE FLOOD CONTROL DIKE AND THE DITCH EAST OF THE LANDFILL WOULD BE COLLECTED THROUGH A GRAVITY DRAINAGE SYSTEM THAT DISCHARGES WATER TO THE RIVER THROUGH CHECK VALVES.

ALTERNATIVE 6 ADDRESSES ALL SITE RISKS, INCLUDING THE POTENTIAL RISK OF FUTURE RELEASES FROM THE LANDFILL. THE FLOOD PROTECTION DIKE WOULD PROVIDE ADDITIONAL PROTECTION TO THE LANDFILL, ONCE THE NEW CLAY COVER IS INSTALLED. ALTERNATIVE 6 WOULD EXCEED OHIO SOLID WASTE CLOSURE REQUIREMENTS AND WOULD COMPLY WITH ARARS FOR CONSTRUCTION IN FLOODPLAINS.

THE COST AND IMPLEMENTATION TIME FOR ALTERNATIVE 6 ARE AS FOLLOWS:

CAPITAL COSTS:	\$9,094,300
PRESENT WORTH O&M COSTS:	\$3,060,000
TOTAL COSTS:	\$12,154,300
TIME TO IMPLEMENT:	18 MONTHS

ALTERNATIVE 7

ALTERNATIVE 7 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * SYNTHETIC MEMBRANE CAP OVER LANDFILL
- * DRAINAGE IMPROVEMENTS
- * LEACHATE COLLECTION SYSTEM
- * GAS VENTING SYSTEM
- * FLOOD PROTECTION DIKE

ALTERNATIVE 7 IS SIMILAR TO ALTERNATIVE 6 EXCEPT THAT A SYNTHETIC MEMBRANE CAP WOULD BE PLACED OVER THE LANDFILL RATHER THAN A CLAY CAP. THE DESIGN OF THE LANDFILL CAP WOULD BE SIMILAR TO THE DESIGN SPECIFIED IN THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA). A PERMEABLE GEOTEXTILE FABRIC WOULD BE PLACED OVER THE GAS COLLECTION AND VENTING SYSTEM, FOLLOWED BY A 2-FOOT-THICK LAYER OF COMPACTED CLAY WITH A PERMEABILITY OF 10-7 CM/SEC. A 20-MIL (MINIMUM) SYNTHETIC MEMBRANE WOULD BE PLACED DIRECTLY ON THE COMPACTED CLAY LAYER. FINALLY, A 12-INCH DRAINAGE LAYER WITH A HYDRAULIC CONDUCTIVITY OF AT LEAST 10-3 CM/SEC WOULD BE PLACED OVER THE SYNTHETIC LINER, FOLLOWED BY A 24-INCH-THICK VEGETATED SOIL COVER. THE FS ESTIMATES THAT THIS CAP WOULD REDUCE INFILTRATION THROUGH THE LANDFILL TO LESS THAN 1 PERCENT OF PRECIPITATION. IN ADDITION, THE FLOOD PROTECTION DIKE WOULD MINIMIZE THE CHANCE OF FLOOD WATERS CONTACTING THE LANDFILL SURFACE.

ALTERNATIVE 7 ADDRESSES ALL SITE RISKS, INCLUDING THE POTENTIAL RISK OF FUTURE RELEASES FROM THE LANDFILL. THIS ALTERNATIVE WOULD EXCEED OHIO SOLID WASTE CLOSURE REQUIREMENTS AND WOULD COMPLY WITH ARARS FOR CONSTRUCTION IN FLOODPLAINS.

THE ESTIMATED COSTS AND IMPLEMENTATION TIME FOR ALTERNATIVE 7 ARE:

CAPITAL COSTS:	\$10,367,400
PRESENT WORTH O&M COSTS:	\$3,499,300
TOTAL COSTS:	\$13,816,700
TIME TO IMPLEMENT:	18 MONTHS

ALTERNATIVE 8

ALTERNATIVE 8 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * SYNTHETIC MEMBRANE CAP OVER LANDFILL
- * EROSION CONTROL AND DRAINAGE IMPROVEMENTS
- * LEACHATE COLLECTION SYSTEM
- * GAS VENTING SYSTEM

ALTERNATIVE 8 IS SIMILAR TO ALTERNATIVE 7, WITHOUT THE FLOOD PROTECTION DIKE. INSTEAD OF THE DIKE, THIS ALTERNATIVE PROVIDES EROSION CONTROL AT THE ENDS OF THE LANDFILL USING RIPRAP AS DESCRIBED UNDER ALTERNATIVE 3. ALL OTHER COMPONENTS OF THIS ALTERNATIVE HAVE BEEN DESCRIBED PREVIOUSLY AND ARE NOT REPEATED HERE.

THE SYNTHETIC MEMBRANE CAP OVER THE LANDFILL WOULD COVER MOST CONTAMINATED SOILS AND WOULD REDUCE LONG-TERM RISKS BY REDUCING INFILTRATION THROUGH THE LANDFILL COVER TO LESS THAN 1 PERCENT OF PRECIPITATION. THIS ALTERNATIVE WOULD EXCEED OHIO SOLID WASTE CLOSURE REQUIREMENTS AND WOULD COMPLY WITH ARARS FOR CONSTRUCTION IN FLOODPLAINS.

THE ESTIMATED COSTS AND IMPLEMENTATION TIME FOR ALTERNATIVE 8 ARE:

CAPITAL COSTS:	\$6,228,500
PRESENT WORTH O&M COSTS:	\$2,328,400
TOTAL COSTS:	\$8,556,900
TIME TO IMPLEMENT:	10 MONTHS

8.9 ALTERNATIVE 9

ALTERNATIVE 9 INCLUDES THE FOLLOWING COMPONENTS:

- * GROUND-WATER MONITORING
- * SITE RESTRICTIONS
- * MANAGEMENT OF SURFACE DEBRIS
- * NATURAL CLAY COVER OVER TOP OF LANDFILL
- * IMPROVEMENTS TO LANDFILL SIDE SLOPES
- * EROSION CONTROL AND DRAINAGE IMPROVEMENTS

ALTERNATIVE 9 IS SIMILAR TO ALTERNATIVE 3, EXCEPT THAT A NATURAL CLAY COVER WOULD BE PLACED ON THE TOP OF THE LANDFILL. THIS CLAY COVER WOULD BE SIMILAR TO THE COVER INSTALLED OVER THE ENTIRE LANDFILL SURFACE IN ALTERNATIVE 4. UNDER ALTERNATIVE 9, SIDE SLOPES WOULD NOT BE COVERED, BUT WOULD BE REPAIRED AS NECESSARY. THESE REPAIRS WOULD BE MADE TO INCREASE THE DEPTH OF THE COVER AND PROVIDE CONTINUOUSLY SLOPING SURFACES. THE TREE COVER ON THE LANDFILL SIDE SLOPES WOULD BE THINNED OUT, BUT MOST TREES WOULD BE LEFT IN PLACE.

DRAINAGE PATTERNS WOULD BE SURVEYED, AND AREAS SUCH AS EROSION RIFTS AND TERRACES WOULD BE FILLED AND REGARDED TO MATCH ADJACENT CONTOURS. THE FILL APPLIED TO THE SIDE SLOPES WOULD BE COMPACTED. WHERE SIDE SLOPES ARE STEEP, ADDITIONAL STABILIZATION WOULD BE ACCOMPLISHED BY PLACING RIPRAP OR BY SUPPORTING THE SLOPES USING SHEET PILING OR SOIL CEMENT.

DRAINAGE CONTROL BERMS WOULD BE CONSTRUCTED AT THE TOP OF THE LANDFILL TO COLLECT STORMWATER RUNOFF. THE WATER COLLECTED BY THE BERMS WOULD BE DIRECTED TO THE BASE OF THE SIDE SLOPES BY DRAINAGE CHUTES. THE COLLECTION AND DRAINAGE SYSTEM WOULD HELP REDUCE INFILTRATION THROUGH THE SIDE SLOPES BY LIMITING THE AREA CONTACTED BY RUNOFF FROM THE TOP OF THE LANDFILL.

ALTERNATIVE 9 ADDRESSES SOME CONTAINMENT ASPECTS FOR CONTAMINATED SOILS BY COVERING THE TOP OF THE LANDFILL AND PROVIDING LIMITED REPAIRS TO THE SIDE SLOPES. HOWEVER, THIS ALTERNATIVE CANNOT ENSURE THAT ALL AREAS OF CONTAMINATED SOIL WOULD BE COVERED. THE LANDFILL SIDE SLOPES WOULD REMAIN LARGELY UNCHANGED AND SUSCEPTIBLE TO EROSION AND INFILTRATION OF PRECIPITATION AND SURFACE WATER DURING FLOOD EVENTS. TREES WOULD NOT BE

REMOVED FROM THE LANDFILL SURFACE, FURTHER INCREASING THE POTENTIAL FOR INFILTRATION. THIS ALTERNATIVE WOULD NOT MEET OHIO CLOSURE REQUIREMENTS FOR SOLID WASTE LANDFILLS BECAUSE OF THE INCOMPLETE REPAIRS TO SIDE SLOPES.

THE COSTS OF ALTERNATIVE 9 AND THE ESTIMATED TIME TO IMPLEMENT THIS ALTERNATIVE ARE:

CAPITAL COSTS:	\$2,483,500
PRESENT WORTH O&M COSTS:	\$955,900
TOTAL COSTS:	\$3,439,400
TIME TO IMPLEMENT:	8 MONTHS

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9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

US EPA USED THE FOLLOWING NINE CRITERIA TO EVALUATE EACH OF THE ALTERNATIVES IDENTIFIED IN THE FS REPORT. THE REMEDIAL ALTERNATIVE SELECTED FOR THE SITE MUST REPRESENT THE BEST BALANCE AMONG THE EVALUATION CRITERIA.

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT ADDRESSES WHETHER A REMEDY ADEQUATELY PROTECTS HUMAN HEALTH AND THE ENVIRONMENT AND WHETHER RISKS ARE PROPERLY ELIMINATED, REDUCED, OR CONTROLLED THROUGH TREATMENT, ENGINEERING CONTROLS, OR INSTITUTIONAL CONTROLS.
2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS ADDRESSES WHETHER A REMEDY MEETS ALL STATE AND FEDERAL LAWS AND REQUIREMENTS THAT APPLY TO SITE CONDITIONS AND CLEANUP OPTIONS.
3. LONG-TERM EFFECTIVENESS AND PERMANENCE REFERS TO THE ABILITY OF A REMEDY TO RELIABLY PROTECT HUMAN HEALTH AND THE ENVIRONMENT OVER TIME ONCE CLEANUP GOALS HAVE BEEN MET.
4. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME ARE THREE PRINCIPAL MEASURES OF THE OVERALL PERFORMANCE OF AN ALTERNATIVE. THE 1986 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) EMPHASIZES THAT, WHENEVER POSSIBLE, US EPA SHOULD SELECT A REMEDY THAT WILL PERMANENTLY REDUCE THE LEVEL OF TOXICITY OF THE CONTAMINANTS AT THE SITE, THE SPREAD OF CONTAMINANTS AWAY FROM THE SITE, AND THE VOLUME, OR AMOUNT, OF CONTAMINANTS AT THE SITE.
5. SHORT-TERM EFFECTIVENESS REFERS TO THE LIKELIHOOD OF ANY ADVERSE IMPACTS TO HUMAN HEALTH OR THE ENVIRONMENT THAT MAY BE POSED DURING THE CONSTRUCTION AND IMPLEMENTATION PERIOD UNTIL CLEANUP GOALS ARE ACHIEVED.
6. IMPLEMENTABILITY IS THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF A REMEDY, INCLUDING THE AVAILABILITY OF MATERIALS AND SERVICES NEEDED TO IMPLEMENT THE REMEDY.
7. COST INCLUDES CAPITAL AND OPERATION AND MAINTENANCE COSTS OF IMPLEMENTING A REMEDY.
8. STATE ACCEPTANCE INDICATES WHETHER, BASED ON ITS REVIEW OF THE RI, EA, FS, AND PROPOSED PLAN, THE STATE OF OHIO (OEPA) CONCURS WITH, OPPOSES, OR HAS NO COMMENT ON THE ALTERNATIVE US EPA IS PROPOSING AS THE REMEDY FOR THE SITE.
9. COMMUNITY ACCEPTANCE INDICATES WHETHER THE PUBLIC CONCURS WITH THE REMEDY PRESENTED IN US EPA'S PROPOSED PLAN.

AFTER EVALUATING ALL THE REMEDIAL ALTERNATIVES DEVELOPED IN THE FS, USING THE NINE CRITERIA JUST DESCRIBED, US EPA HAS SELECTED ALTERNATIVE 4 TO ADDRESS CONTAMINATION AT THE BOWERS LANDFILL SUPERFUND SITE. THE RATIONALE FOR THIS SELECTION IS PROVIDED BELOW.

9.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

ALTERNATIVE 4 WOULD PROTECT BOTH HUMAN HEALTH AND THE ENVIRONMENT. THIS ALTERNATIVE WOULD REDUCE POTENTIAL RISKS FROM INGESTION OF CONTAMINATED SOIL BY INSTALLING A FENCE AROUND THE SITE AND BY COVERING THE MOST

HIGHLY CONTAMINATED SOILS WITH 4 FEET OF CLAY AND SOIL. THE FS ESTIMATES THAT PROBABLE CASE RISKS FOR SOIL INGESTION WOULD BE REDUCED TO ZERO. SOME RESIDUAL RISK WOULD REMAIN DUE TO CONTAMINATED SOILS IN THE FIELD WEST OF THE LANDFILL. TO ESTIMATE EXPOSURE TO THIS REMAINING CONTAMINATION, THE FS ASSUMED THAT (1) 50-KG TEENAGERS WOULD SCALE THE FENCE SURROUNDING THE SITE 10 TIMES PER YEAR OVER A 5-YEAR PERIOD, (2) THESE TEENAGERS WOULD INGEST 200 MG OF CONTAMINATED SOIL PER VISIT, AND (3) 50 PERCENT OF THE CONTAMINANTS IN INGESTED SOIL WOULD BE ABSORBED BY THE BODY. BASED ON THESE ASSUMPTIONS AND THE MAXIMUM SOIL CONTAMINATED CONCENTRATIONS IN THE AREAS NOT AFFECTED BY THE COVER, THE HI FOR NONCARCINOGENIC RISKS WOULD BE REDUCED FROM 3.48 TO 0.24. THE CARCINOGENIC RISK, BASED ON AVERAGE LIFETIME EXPOSURE, WOULD BE REDUCED FROM 3×10^{-6} TO 4×10^{-8} . RISK REDUCTIONS FOR ALTERNATIVES 5 THROUGH 8, WHICH COVER THE SAME AREAS OF SOIL CONTAMINATION, WOULD BE IDENTICAL. IN CONTRAST, ALTERNATIVES 2, 3, AND 9 DO NOT COVER THE ENTIRE LANDFILL SURFACE AND WOULD PROVIDE A SMALLER RISK REDUCTION. THE FS ESTIMATES THAT THESE ALTERNATIVES WOULD RESULT IN AN HI OF 0.28 FOR NONCARCINOGENIC EFFECTS AND A CARCINOGENIC RISK OF 5×10^{-7} .

ALTERNATIVE 4 WOULD REDUCE RISKS FROM INGESTION OF GROUND WATER BY PLACING ACCESS RESTRICTIONS ON THE AREA WEST OF THE LANDFILL. THESE RESTRICTIONS WOULD PREVENT THE USE OF THIS AREA AS A FUTURE GROUND-WATER SOURCE. IN ADDITION, THE CLAY AND SOIL CAP WOULD REDUCE INFILTRATION TO LESS THAN 10 PERCENT OF PRECIPITATION, REDUCING THE LIKELIHOOD OF FUTURE GROUND-WATER CONTAMINATION. ALTERNATIVES 5 AND 6, WHICH HAVE A SIMILAR CAP, WOULD ALSO REDUCE INFILTRATION TO LESS THAN 10 PERCENT. ALTERNATIVES 7 AND 8, WHICH INCLUDE A SYNTHETIC MEMBRANE CAP, WOULD PROVIDE MUCH GREATER REDUCTIONS IN INFILTRATION.

GROUND-WATER USERS FARTHER FROM BOWERS LANDFILL WOULD BE PROTECTED BY THE MONITORING PROGRAM INCLUDED AS PART OF ALTERNATIVE 3. THIS PROGRAM WOULD INCLUDE INSTALLING AND SAMPLING ADDITIONAL WELLS SOUTH AND WEST OF THE LANDFILL. EXPANSION OF THE MONITORING NETWORK TO THE SOUTH WOULD DETECT ANY FUTURE MIGRATION OF GROUND-WATER CONTAMINATION TOWARD THE CITY OF CIRCLEVILLE'S WELLFIELD, 1 1/2 MILES SOUTH OF THE LANDFILL. ALTERNATIVE 4 WOULD INCLUDE A CORRECTIVE ACTION PROGRAM THAT WOULD ALLOW PROMPT RESPONSE TO ANY SIGNIFICANT INCREASES IN GROUND-WATER CONTAMINATION THAT MIGHT OCCUR IN THE FUTURE.

OVERALL, ALTERNATIVE 4 WOULD BE MORE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT THAN ALTERNATIVES 1, 2, 3, AND 9. THESE ALTERNATIVES INCLUDE EITHER NO MODIFICATIONS OR LIMITED MODIFICATIONS TO THE EXISTING LANDFILL SURFACE.

ALTERNATIVE 4 WOULD BE SOMEWHAT LESS PROTECTIVE THAN ALTERNATIVES 5, 6, 7, AND 8, WHICH INCLUDE MORE EXTENSIVE REMEDIATION. FOR EXAMPLE, ALTERNATIVE 7, THE MOST PROTECTIVE ALTERNATIVE, ALSO INCLUDES A SYNTHETIC MEMBRANE CAP, A FLOOD PROTECTION DIKE, A LEACHATE COLLECTION SYSTEM, AND A GAS VENTING SYSTEM. THE OVERALL EFFECT OF THESE ADDITIONAL MEASURES WOULD NOT INCREASE PROTECTION WITH RESPECT TO INGESTING CONTAMINATED SOILS OR GROUND WATER. THE FLOOD PROTECTION DIKE INCLUDED IN ALTERNATIVES 6 AND 7 MAY PROLONG THE EFFECTIVE LIFE OF THE LANDFILL CAP DUE TO LESS EROSION FROM SURFACE WATER. HOWEVER, THE CAP INSTALLED UNDER ALTERNATIVE 4 WOULD BE DESIGNED AND CONSTRUCTED TO RESIST FLOOD DAMAGE OR WASHOUT OF WASTES BY A 100-YEAR FLOOD AND WOULD HAVE A MINIMUM 30-YEAR LIFETIME. THE MULTILAYER CAP INCLUDED IN ALTERNATIVES 7 AND 8 MIGHT PROVIDE GREATER REDUCTIONS IN INFILTRATION, THUS PROVIDING GREATER PROTECTION AGAINST THE GENERATION OF CONTAMINATED LEACHATE AND FUTURE GROUND-WATER CONTAMINATION. HOWEVER, THERE IS LITTLE EVIDENCE OF A LEACHATE PROBLEM AT BOWERS LANDFILL, AND CURRENT LEVELS OF GROUND-WATER CONTAMINATION ARE LOW. THEREFORE, THE LOW-PERMEABILITY CLAY CAP CONSTRUCTED UNDER ALTERNATIVE 4 WOULD PROVIDE ADEQUATE PROTECTION OF GROUND WATER.

9.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ALTERNATIVE 4 WOULD COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE STATE AND FEDERAL REQUIREMENTS (ARARS). THESE REQUIREMENTS INCLUDE ACTION-SPECIFIC ARARS RELATED TO CLOSURE OF BOWERS LANDFILL, LOCATION-SPECIFIC REQUIREMENTS RELATED TO THE LOCATION OF THE LANDFILL WITHIN THE 100-YEAR FLOODPLAIN OF THE SCIOTO RIVER, AND CHEMICAL-SPECIFIC ARARS FOR CONTAMINANTS IDENTIFIED IN ENVIRONMENTAL MEDIA AT THE LANDFILL.

ALTERNATIVE 4 IS PRIMARILY A CLOSURE PLAN FOR BOWERS LANDFILL, AND THE MAJOR ACTION-SPECIFIC ARARS TO BE CONSIDERED ARE THOSE RELATED TO LANDFILL CLOSURE. WASTE DISPOSAL AT BOWERS LANDFILL ENDED AROUND 1968, BEFORE THE EFFECTIVE DATE OF RCRA. THUS, RCRA SUBTITLE C REQUIREMENTS FOR THE TREATMENT, STORAGE, AND DISPOSAL OF HAZARDOUS WASTES ARE NOT APPLICABLE TO REMEDIAL ACTIONS AT THE LANDFILL. ADDITIONALLY, THE WASTES IN BOWERS LANDFILL CONTAIN LARGE VOLUMES OF LOW-TOXICITY MATERIAL, WIDELY DISPERSED OVER A LARGE AREA

THAT BEARS LITTLE RESEMBLANCE TO THE DISCRETE UNITS REGULATED UNDER RCRA SUBTITLE C. NEVERTHELESS, PORTIONS OF RCRA SUBTITLE C REQUIREMENTS CAN BE CONSIDERED RELEVANT AND APPROPRIATE.

THE PREAMBLE TO PROPOSED REVISIONS TO THE NATIONAL CONTINGENCY PLAN (53 FEDERAL REGISTER, DECEMBER 21, 1988) DESCRIBES SEVERAL OPTIONS FOR CLOSURE OF SUPERFUND SITES, BASED ON RCRA REQUIREMENTS. ONE OPTION IS "CLOSURE WITH WASTES IN PLACE". THIS OPTION REQUIRES A FINAL COVER OVER THE CONTAMINATED MATERIALS AND POST-CLOSURE CARE, INCLUDING MAINTENANCE OF THE COVER, GROUND-WATER MONITORING, AND CORRECTIVE ACTION IF GROUND-WATER PROTECTION STANDARDS ARE EXCEEDED IN THE FUTURE. A SECOND OPTION IS "ALTERNATE LAND DISPOSAL CLOSURE". UNDER THIS OPTION, LANDFILL COVER REQUIREMENTS ARE RELAXED BECAUSE (1) THE COVER WILL REDUCE RISKS DUE TO DIRECT CONTACT WITH WASTES AND (2) THE WASTES APPEAR TO POSE A LIMITED THREAT TO GROUND WATER.

ALTERNATIVE 4 FALLS BETWEEN THESE TWO OPTIONS, BUT CLOSER TO THE FIRST OPTION. THE CLAY CAP INSTALLED AS PART OF THIS ALTERNATIVE WOULD HAVE A PERMEABILITY OF 10^{-7} OR LESS. THIS CAP WOULD MEET THE REQUIREMENTS FOR THE CLAY LAYER AT THE BOTTOM OF A HAZARDOUS WASTE LANDFILL, AS DESCRIBED IN 40 CFR 264.301. BECAUSE CURRENT GROUND-WATER CONTAMINATION LEVELS AT BOWERS LANDFILL SUGGEST A LIMITED THREAT TO GROUND WATER, A SYNTHETIC MEMBRANE LAYER IS NOT CONSIDERED A NECESSARY COMPONENT OF THE CAP. ON THE OTHER HAND, ALTERNATIVE 4 WOULD EXCEED THE RELAXED COVER REQUIREMENTS FOR "ALTERNATE LAND DISPOSAL CLOSURE". THESE REQUIREMENTS ARE MORE SIMILAR TO STATE OF OHIO CLOSURE REGULATIONS FOR SOLID WASTE LANDFILL, WHICH CALL FOR A "WELL COMPACTED LAYER OF FINAL COVER MATERIAL TO A DEPTH OF AT LEAST TWO FEET". ALTERNATIVE 4 WOULD SUBSTANTIALLY EXCEED THIS REQUIREMENT BY PROVIDING A 4-FOOT THICK COVER, INCLUDING A 2-FOOT LAYER OF LOW-PERMEABILITY CLAY.

ALTERNATIVE 4 WOULD ALSO COMPLY WITH LOCATION-SPECIFIC ARARS. BECAUSE BOWERS LANDFILL IS LOCATED WITHIN THE 100-YEAR FLOODPLAIN OF THE SCIOTO RIVER, CONSTRUCTION WITHIN THE FLOODPLAIN IS UNAVOIDABLE. HOWEVER, ALTERNATIVE 4 WOULD BE CONSTRUCTED IN A MANNER THAT WOULD MINIMIZE POTENTIAL HARM TO THE FLOODPLAIN, AS SPECIFIED BY FLOODPLAIN MANAGEMENT REQUIREMENTS IN 40 CFR 6. IN ADDITION, THE CAP WOULD BE CONSTRUCTED, OPERATED, AND MAINTAINED TO PREVENT WASHOUT OF ANY HAZARDOUS WASTES BY A 100-YEAR FLOOD, AS REQUIRED BY RCRA GENERAL FACILITY STANDARDS IN 40 CFR 264.18.

ALTERNATIVE 4 WOULD ATTAIN CHEMICAL-SPECIFIC ARARS FOR GROUND WATER BY REDUCING INFILTRATION OF PRECIPITATION AND FLOODWATERS THROUGH THE LANDFILL WASTE. GROUND-WATER RESULTS FROM THE RI SHOWED THAT BENZENE SLIGHTLY EXCEEDED THE MCL OF 5 UG/L IN ONE SAMPLE FROM WELL P-6B. LEVELS IN OTHER SAMPLES FROM THIS WELL WERE BELOW THE MCL, AND BENZENE WAS NOT DETECTED IN ANY OF THE REMAINING 12 DOWNGRAIDENT WELLS. BARIUM ALSO EXCEEDED THE MCL IN THREE SAMPLES COLLECTED FROM A SINGLE WELL, WELL P-5B. HOWEVER, THE AVERAGE BARIUM CONCENTRATION WAS WELL BELOW THE MCL. THE GROUND-WATER MONITORING PROGRAM IMPLEMENTED UNDER ALTERNATIVE 4 WOULD REQUIRE REGULAR AND SYSTEMATIC SAMPLING AND WOULD MEET THE SUBSTANTIVE REQUIREMENTS FOR GROUND-WATER MONITORING UNDER RCRA IN 40 CFR 264, SUBPART F. THE MONITORING PROGRAM WOULD INCLUDE PROVISIONS FOR CORRECTIVE ACTION SHOULD CONTAMINANT LEVELS SIGNIFICANTLY INCREASE IN THE FUTURE.

ADDITIONALLY, THE MONITORING PROGRAM PROPOSED FOR ALTERNATIVE 4 WOULD INCLUDE COLLECTING SURFACE WATER SAMPLES FROM THE DITCH EAST OF BOWERS LANDFILL. SURFACE WATER MONITORING WOULD VERIFY THAT DISCHARGES FROM THE DITCH ARE COMPLYING WITH OHIO WATER QUALITY STANDARDS AS DESCRIBED IN OAC 3745-01.

ALTERNATIVE 5 AND 6 WOULD COMPLY WITH ARARS TO THE SAME EXTENT AS ALTERNATIVE 4. ALTERNATIVES 7 AND 8, BY INCLUDING A SYNTHETIC MEMBRANE LAYER IN ADDITION TO THE LOW-PERMEABILITY CLAY LAYER, WOULD COME CLOSER TO MEETING RCRA REQUIREMENTS FOR CLOSURE WITH HAZARDOUS WASTES IN PLACE.

ALTERNATIVES 1, 2, 3, AND 9 WOULD LEAVE SOME OR ALL OF THE CURRENT SOIL AND VEGETATION COVER INTACT. THESE ALTERNATIVES WOULD NOT COMPLY WITH RELEVANT AND APPROPRIATE PORTIONS OF RCRA CLOSURE REGULATIONS OR WITH OHIO CLOSURE STANDARDS FOR SOLID WASTE LANDFILLS. FURTHER, THESE ALTERNATIVES WOULD NOT MEET LOCATION-SPECIFIC ARARS BECAUSE THEY WOULD NOT BE CONSTRUCTED, OPERATED, AND MAINTAINED TO PREVENT WASHOUT OF HAZARDOUS WASTES BY A 100-YEAR FLOOD. ALSO, ALTERNATIVES 1, 2, 3, AND 9 WOULD NOT SIGNIFICANTLY REDUCE INFILTRATION OF PRECIPITATION AND FLOOD WATERS THROUGH THE LANDFILL, AND MAY NOT RESULT IN ATTAINMENT OF MCLS IN GROUND WATER.

9.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

BECAUSE OF THE LARGE AMOUNT OF MATERIAL WITHIN BOWERS LANDFILL, THE SMALL KNOWN PERCENTAGE OF HAZARDOUS

WASTE, AND THE LIMITED RISKS IDENTIFIED IN THE EA REPORT, IT WAS NOT FEASIBLE TO DEVELOP A PERMANENT REMEDY FOR BOWERS LANDFILL. HOWEVER, A LOW-PERMEABILITY CLAY CAP SPECIFIED BY ALTERNATIVE 4 WOULD BE DESIGNED FOR A MINIMUM 30-YEAR LIFETIME. THE LONG-TERM EFFECTIVENESS OF ALTERNATIVE 4 WOULD BE ENSURED BY GROUND-WATER MONITORING AND MAINTENANCE OF THE CLAY CAP. MONITORING WELLS DOWNGRADIENT OF THE LANDFILL WOULD BE SAMPLED ON A REGULAR BASIS TO DETERMINE IF CONTAMINANT CONCENTRATIONS IN GROUND WATER ARE INCREASING SIGNIFICANTLY OVER TIME. THE MONITORING PROGRAM WOULD ALSO INCLUDE A CORRECTIVE ACTION COMPONENT, REQUIRING FURTHER REMEDIAL ACTION IF A SIGNIFICANT INCREASE IN GROUND-WATER CONTAMINATION IS DETECTED. THE MAINTENANCE PROGRAM FOR ALTERNATIVE 4 WOULD INCLUDE REGULARLY MOWING THE VEGETATION ON THE CAP; INSPECTING THE SURFACE FOR CRACKS, SETTLEMENT, PONDING, AND EROSION; COMPLETING APPROPRIATE REPAIRS TO THE CAP; AND REPAIRING THE FENCE AS NECESSARY. IN ADDITION TO REGULARLY SCHEDULED INSPECTIONS, ADDITIONAL INSPECTIONS WOULD BE MADE AFTER FLOODS.

SIMILAR MONITORING, INSPECTION, AND MAINTENANCE WOULD BE NEEDED TO MAINTAIN THE LONG-TERM EFFECTIVENESS OF ALTERNATIVES 5, 6, 7, AND 8. THESE ALTERNATIVES INCLUDE ADDITIONAL COMPONENTS, SUCH AS A SYNTHETIC MEMBRANE CAP OR A FLOOD PROTECTION DIKE, THAT MAY INCREASE LONG-TERM EFFECTIVENESS. HOWEVER, THE ADDITIONAL COMPONENTS WOULD NOT GREATLY INCREASE LONG-TERM EFFECTIVENESS COMPARED TO ALTERNATIVE 4. CURRENT LANDFILL CONDITIONS, 20 YEARS AFTER DISPOSAL CEASED, INDICATE THAT ALTERNATIVE 4 WOULD BE SUFFICIENTLY PROTECTIVE IN THE LONG-TERM. THUS, THE SLIGHTLY HIGHER LONG-TERM EFFECTIVENESS OF ALTERNATIVES 5, 6, 7, AND 8 DOES NOT JUSTIFY THE SUBSTANTIALLY HIGHER COSTS OF THESE ALTERNATIVES.

IN CONTRAST, ALTERNATIVES 1, 2, 3, AND 9 WOULD BE MUCH LESS EFFECTIVE IN LONG TERM. ALTERNATIVES 1 AND 2 DO NOT INCLUDE ANY REPAIRS TO THE EXISTING LANDFILL COVER. ALTERNATIVES 3 AND 9 MAKE LIMITED REPAIRS, BUT WOULD NOT COVER THE ENTIRE LANDFILL SURFACE. ALTERNATIVES 1, 2, 3, AND 9 WOULD ALSO LEAVE TREES ON THE LANDFILL SIDE SLOPES. THESE ALTERNATIVES WOULD ALLOW GREATER INFILTRATION OF PRECIPITATION AND FLOOD WATERS THAN ALTERNATIVES 4 THROUGH 8 BECAUSE OF THE INCOMPLETE COVER AND BECAUSE TREE ROOTS PROBABLY PENETRATE INTO WASTE MATERIALS BELOW THE COVER. THESE ALTERNATIVES WOULD ALSO HAVE A GREATER POTENTIAL FOR LONG-TERM FAILURE OF THE LANDFILL SIDE SLOPES. OVER TIME, THE COMBINATION OF SATURATED SOIL CONDITIONS DURING FLOODING AND HIGH WINDS COULD RESULT IN COMPLETE UPROOTING OF TREES, EXPOSING UNDERLYING WASTE MATERIALS.

9.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

NONE OF THE REMEDIAL ALTERNATIVES EVALUATED IN THE FS REPORT INVOLVES TREATING SOURCE MATERIALS FROM BOWERS LANDFILL. THUS, NONE OF THE ALTERNATIVES WOULD REDUCE THE TOXICITY OR VOLUME OF HAZARDOUS CONSTITUENTS WITHIN THE WASTE. TREATMENT ALTERNATIVES FOR THE SOURCE MATERIALS WERE CONSIDERED BUT WERE NOT EVALUATED IN DETAIL FOR SEVERAL REASONS. FIRST, MOST OF THE ESTIMATED 130,000 CUBIC YARDS OF WASTE MATERIAL IN BOWERS LANDFILL CONSISTS OF GENERAL REFUSE AND MUNICIPAL SOLID WASTE. ALTHOUGH THE EXACT AMOUNT OF HAZARDOUS WASTE PLACED IN THE LANDFILL IS NOT KNOWN, IT IS PROBABLY A SMALL PERCENTAGE OF THE TOTAL WASTE VOLUME. THE LARGE VOLUME AND VARIABLE COMPOSITION OF WASTES MAKES TREATMENT IMPRACTICAL. SECOND, NO OPERATING RECORDS EXIST FOR THE LANDFILL. THUS, IT IS NOT FEASIBLE TO IDENTIFY LOCATIONS WHERE HAZARDOUS WASTES MIGHT HAVE BEEN PLACED. THIRD, THE RELATIVELY LOW LEVELS OF CONTAMINATION FOUND DURING THE RI WOULD NOT BE EFFECTIVELY REDUCED BY TREATMENT.

ALTERNATIVES 5, 6, 7, AND 8 INCLUDE PROVISIONS FOR INSTALLING A LEACHATE COLLECTION AND TREATMENT SYSTEM, WHICH IS A TREATMENT ALTERNATIVE. THIS SYSTEM MAY REDUCE THE VOLUME AND MOBILITY OF LEACHATE IF LEACHATE CONTAINS HAZARDOUS CONSTITUENTS. HOWEVER, GROUND-WATER ANALYSES FROM THE RI DID NOT INDICATE SIGNIFICANTLY ELEVATED CONTAMINANT LEVELS IN THE UPPER AQUIFER, WHICH WOULD BE THE FIRST TARGET OF A LEACHATE PLUME. ADDITIONALLY, THE LOW-PERMEABILITY CLAY CAP INSTALLED UNDER ALTERNATIVE 4 SHOULD GREATLY REDUCE FUTURE LEACHATE GENERATION BY REDUCING INFILTRATION THROUGH THE LANDFILL. FOR THESE REASONS, THE INSTALLATION OF A LEACHATE COLLECTION SYSTEM WAS CONSIDERED BUT THEN REJECTED.

SIMILARLY, ALTERNATIVES 5, 6, 7, AND 8 INCLUDE A COLLECTION SYSTEM FOR GASES GENERATED BY THE LANDFILL. COLLECTED GASES COULD BE TREATED, IF NECESSARY. HOWEVER, ALTERNATIVE 4 DOES NOT INCLUDE GAS COLLECTION AND TREATMENT FOR THE FOLLOWING REASONS. FIRST, AIR MONITORING RESULTS FROM THE RI SHOWED THAT AIR CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (VOCs) AT BOWERS LANDFILL ARE SIMILAR TO OFF-SITE BACKGROUND CONCENTRATIONS. SECOND, THE LANDFILL HAS A LOW POTENTIAL TO EMIT VOCs TO AIR BECAUSE OF THE LOW CONCENTRATIONS OF VOCs IN SOILS, SEDIMENTS, AND SURFACE WATER ON OR ADJACENT TO THE LANDFILL. FINALLY, BECAUSE OF THE AGE OF THE LANDFILL, MOST OF THE POTENTIAL GAS GENERATION MAY ALREADY HAVE TAKEN PLACE. THESE

GASES WOULD HAVE READILY ESCAPED THROUGH THE HIGHLY PERMEABLE SOIL THAT NOW COVERS THE LANDFILL.

ALTERNATIVE 4 WOULD REDUCE THE MOBILITY OF WASTE MATERIALS WITHIN THE LANDFILL. THE FS REPORT ESTIMATES THAT THE LOW-PERMEABILITY CLAY CAP INCLUDED IN THIS ALTERNATIVE WILL REDUCE DIRECT INFILTRATION INTO THE LANDFILL SURFACE BY OVER 90 PERCENT. THIS IS MUCH MORE EFFECTIVE THAN THE CURRENT SOIL AND VEGETATION COVER. REDUCING THE AMOUNT OF WATER THAT CONTACTS WASTE MATERIALS WITHIN THE LANDFILL SHOULD REDUCE THE MOBILITY OF THESE MATERIALS. ALTERNATIVES 5 AND 6, WHICH ALSO INCLUDE A CLAY CAP, WOULD PROVIDE SIMILAR REDUCTIONS IN INFILTRATION. ALTERNATIVES 7 AND 8, WHICH INCLUDE A SYNTHETIC PLASTIC LINER AND A CLAY CAP, WOULD FURTHER REDUCE INFILTRATION (ESTIMATED IN THE FS REPORT AS GREATER THAN 99 PERCENT). HOWEVER, THESE MUCH GREATER REDUCTIONS DO NOT APPEAR WARRANTED BY CURRENT LEVELS OF GROUND-WATER CONTAMINATION AT BOWERS LANDFILL.

IN CONTRAST, ALTERNATIVES 1 AND 2 (NO REPAIRS TO THE EXISTING COVER), ALTERNATIVE 3 (LIMITED REPAIRS TO THE COVER), AND ALTERNATIVE 9 (APPLICATION OF A PARTIAL CLAY COVER) WOULD PROVIDE EITHER NO REDUCTION OR LESS REDUCTION IN INFILTRATION. EACH OF THESE ALTERNATIVES WOULD LEAVE TREES ON THE LANDFILL SIDE SLOPES. ROOT SYSTEMS OF THESE TREES WOULD PROVIDE A DIRECT PATH BETWEEN FLOOD WATERS OR PRECIPITATION AND THE UNDERLYING WASTE MATERIALS.

9.5 SHORT-TERM EFFECTIVENESS

THE FS REPORT ESTIMATES THAT ALTERNATIVE 4 COULD BE CONSTRUCTED WITHIN 10 MONTHS; THE ALTERNATIVE WOULD EFFECTIVELY PROTECT HUMAN HEALTH AND THE ENVIRONMENT IMMEDIATELY UPON COMPLETION. THIS CONSTRUCTION PERIOD IS LONGER THAN THE 1 MONTH REQUIRED FOR ALTERNATIVE 3, WHICH INCLUDES ONLY LIMITED REPAIRS TO THE EXISTING LANDFILL COVER. ALTERNATIVES 5, 8, AND 9 WOULD REQUIRE CONSTRUCTION PERIODS SIMILAR TO THAT FOR ALTERNATIVE 4. HOWEVER, ALTERNATIVES 6 AND 7 WOULD REQUIRE APPROXIMATELY 18 MONTHS TO COMPLETE DUE TO THE MORE EXTENSIVE CONSTRUCTION ACTIVITIES.

ALTERNATIVE 4 AND THE OTHER ALTERNATIVES COULD BE CONSTRUCTED WITHOUT SIGNIFICANT ADVERSE IMPACTS ON THE ENVIRONMENT AND PEOPLE LIVING NEAR BOWERS LANDFILL. HOWEVER, ALL THE ALTERNATIVES, WITH THE EXCEPTION OF THOSE REQUIRING NO CONSTRUCTION, WOULD PRESENT GENERAL SAFETY-RELATED RISKS TO CONSTRUCTION WORKERS. IN ADDITION, EARTH MOVING ACTIVITIES COULD GENERATE DUST FROM THE LANDFILL SURFACE THAT COULD POTENTIALLY AFFECT WORKERS AND SURROUNDING POPULATIONS. HOWEVER, THESE EFFECTS COULD BE MINIMIZED BY USING STANDARD DUST SUPPRESSION METHODS, SUCH AS WATERING. ADDITIONALLY, AIR MONITORING WOULD BE CONDUCTED TO MEASURE CONTAMINANTS RELEASED DURING CONSTRUCTION. CONSTRUCTION PRACTICES WOULD BE MODIFIED AS NECESSARY TO PREVENT UNACCEPTABLE RELEASES.

A MAJOR IMPACT OF ALTERNATIVE 4 ON THE SURROUNDING COMMUNITY WOULD BE INCREASED TRUCK TRAFFIC NEAR THE SITE. THE FS REPORT ESTIMATES THAT APPROXIMATELY 8,000 TRUCKLOADS OF MATERIAL WOULD ENTER AND LEAVE THE SITE DURING CONSTRUCTION. OVER A 10-MONTH PERIOD, THIS FIGURE CORRESPONDS TO AN AVERAGE OF 40 TRUCKS PER WORK DAY. THIS COULD INCONVENIENCE LOCAL RESIDENTS, ADVERSELY AFFECT LOCAL ROADS, AND PRESENT A SLIGHTLY GREATER RISK OF TRAFFIC ACCIDENTS NEAR THE SITE. INCREASED TRUCK TRAFFIC IS ALSO A COMPONENT OF OTHER CONSTRUCTION ALTERNATIVES. THE ESTIMATED TOTAL NUMBER OF TRUCKS VARIES FROM 1,225 FOR ALTERNATIVE 3 TO 12,000 FOR ALTERNATIVES 6 AND 7.

9.6 IMPLEMENTABILITY

ALTERNATIVE 4, AND ALL OTHER ALTERNATIVES EVALUATED IN THE FS REPORT, COULD BE IMPLEMENTED USING STANDARD EARTH MOVING EQUIPMENT AND CONSTRUCTION TECHNIQUES. HOWEVER, THE PRIMARY PROBLEM OF FLOODING COULD AFFECT THE IMPLEMENTATION OF ALL ALTERNATIVES EXCEPT ALTERNATIVE 1 (NO ACTION). CONSTRUCTION ACTIVITIES WOULD HAVE TO BE SCHEDULED AROUND FLOOD EVENTS, SINCE THE AREA ADJACENT TO THE LANDFILL IS INUNDATED APPROXIMATELY 30 DAYS PER YEAR. CONSTRUCTION OF ALTERNATIVES 4 THROUGH 9 IS ESTIMATED TO REQUIRE 8 TO 18 MONTHS TO COMPLETE. THUS, REMEDIAL ACTION WOULD HAVE TO BE SEGMENTED INTO WORK AREAS. WORK ON ONE AREA OF THE LANDFILL WOULD BE COMPLETED BEFORE CONSTRUCTION OF THE NEXT AREA BEGAN. THIS METHOD WOULD MINIMIZE THE AREA OF THE LANDFILL EXPOSED TO ANY PARTICULAR FLOOD EVENT.

A SECOND IMPLEMENTATION PROBLEM, COMMON TO ALTERNATIVES 3 THROUGH 9, IS THE AVAILABILITY OF LOW-PERMEABILITY CLAY NEAR THE LANDFILL. THESE ALTERNATIVES WOULD REQUIRE SUBSTANTIAL AMOUNTS (UP TO 50,000 CUBIC YARDS) OF CLAY FOR CONSTRUCTION. THE FS REPORT ASSUMES THAT A SUITABLE CLAY SOURCE CAN BE FOUND LOCALLY. HOWEVER, IF

A LOCAL SOURCE CANNOT BE FOUND, INCREASED TRANSPORT OF CLAY WOULD BE REQUIRED, RESULTING IN INCREASED COSTS.

A THIRD IMPLEMENTATION PROBLEM AFFECTS ALTERNATIVES 3 THROUGH 9. THESE ALTERNATIVES WOULD REQUIRE REMOVING EXISTING VEGETATION FROM ALL OR PART OF THE LANDFILL. THIS ACTIVITY, ESPECIALLY THE REMOVAL OF LARGE TREES, COULD EXPOSE UNDERLYING WASTE MATERIALS. PRECAUTIONS WOULD BE TAKEN TO MINIMIZE THIS POSSIBILITY.

NONE OF THE ALTERNATIVES APPEARS TO PRESENT ANY MAJOR ADMINISTRATIVE PROBLEMS THAT WOULD AFFECT IMPLEMENTATION. HOWEVER, THE FLOOD PROTECTION DIKE INCLUDED IN ALTERNATIVES 6 AND 7 WOULD INVOLVE SUBSTANTIAL CONSTRUCTION IN THE SCIOTO RIVER FLOODPLAIN. CONSTRUCTION OF THE DIKE WOULD REMOVE APPROXIMATELY 80 ACRES OF LAND FROM THE 100-YEAR FLOODPLAIN, SINCE THE DIKE WOULD PREVENT FLOODWATERS FROM COVERING THIS AREA. THIS WOULD INCREASE THE HEIGHT OF FLOODWATERS UPSTREAM AND DOWNSTREAM OF THE LANDFILL AND MAY CAUSE ADDITIONAL AREAS TO FLOOD. BECAUSE OF THIS POTENTIAL PROBLEM, ALTERNATIVES 6 AND 7 MAY BE ADMINISTRATIVELY MORE DIFFICULT TO IMPLEMENT.

9.7 COST

THE ESTIMATED TOTAL PRESENT WORTH COST FOR ALTERNATIVE 4 IS APPROXIMATELY \$4.3 MILLION. THIS ESTIMATE INCLUDES CAPITAL COSTS OF APPROXIMATELY \$3.2 MILLION FOR FENCING, DRAINAGE IMPROVEMENTS, EROSION AND FLOOD CONTROL MEASURES, AND INSTALLATION OF THE LANDFILL CAP. ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS FOR THIS ALTERNATIVE ARE ESTIMATED AT APPROXIMATELY \$116,000 AND INCLUDE EXPENSES RELATED TO GROUND-WATER MONITORING AND GENERAL MAINTENANCE OF THE FENCE, DRAINAGE SYSTEM, EROSION AND FLOOD CONTROL MEASURES, AND LANDFILL CAP. THE PRESENT WORTH OF ANNUAL O&M COSTS (OVER A 30-YEAR PERIOD AT A 10 PERCENT INTEREST RATE) IS APPROXIMATELY \$1.1 MILLION.

ALTERNATIVE 4 WOULD BE MORE EXPENSIVE TO IMPLEMENT THAN ALTERNATIVES 1, 2, 3, AND 9. HOWEVER, THESE ALTERNATIVES WOULD NOT PROVIDE THE DEGREE OF OVERALL PROTECTION OFFERED BY ALTERNATIVE 4. ALTERNATIVES 5, 6, 7, AND 8 WOULD PROVIDE SOMEWHAT GREATER PROTECTION THAN ALTERNATIVE 4, BUT AT A MUCH GREATER COST. ESTIMATED TOTAL PRESENT WORTH COST FOR THESE ALTERNATIVES RANGE FROM \$6.7 MILLION TO \$13.8 MILLION. INCREASED COSTS ARE ASSOCIATED WITH MORE SOPHISTICATED TECHNOLOGIES SUCH AS A LEACHATE COLLECTION SYSTEM AND GAS VENTING SYSTEM (ALTERNATIVES 5 THROUGH 8), A FLOOD PROTECTION DIKE (ALTERNATIVES 6 AND 7), AND A LANDFILL CAP WITH A SYNTHETIC LINER (ALTERNATIVES 7 AND 8).

THE TOTAL COST OF ALTERNATIVE 5 IS APPROXIMATELY 50 PERCENT HIGHER THAN ALTERNATIVE 4 (\$6.7 MILLION COMPARED TO \$4.3 MILLION), WHILE ALTERNATIVES 6 THROUGH 8 INVOLVE MUCH GREATER COSTS (\$12.2 MILLION, \$13.8 MILLION, AND \$8.6 MILLION RESPECTIVELY). ALTHOUGH THESE ALTERNATIVES MAY OFFER INCREASED LONG-TERM PROTECTION, THE RELATIVE COST INCREASE OUTWEIGHS THE EXPECTED BENEFITS. FOR EXAMPLE, THE INSTALLATION OF A GAS VENTING SYSTEM DOES NOT APPEAR NECESSARY. SEVERAL FACTORS INDICATE THAT GAS GENERATION IS NOT A PROBLEM AT BOWERS LANDFILL. SUCH FACTORS INCLUDE THE AGE OF THE LANDFILL, THE POROUS NATURE OF THE CURRENT LANDFILL COVER, THE FREQUENT FLOODING OF THE LANDFILL, AND THE LACK OF ELEVATED VOC AND GAS LEVELS DURING THE RI. LIKEWISE, THE INSTALLATION OF A LEACHATE COLLECTION SYSTEM DOES NOT APPEAR JUSTIFIED BECAUSE OF LITTLE EVIDENCE THAT LEACHATE IS SIGNIFICANTLY AFFECTING THE UPPER AQUIFER. THE LOW-PERMEABILITY CLAY CAP INSTALLED UNDER ALTERNATIVE 4 WOULD FURTHER REDUCE LEACHATE GENERATION. THE INSTALLATION OF A RCRA CAP AND FLOOD PROTECTION DIKE ARE LIKEWISE NOT JUSTIFIED. A RCRA CAP WOULD DECREASE INFILTRATION TO LESS THAN 1 PERCENT OF PRECIPITATION. HOWEVER, AT A MUCH LOWER COST, THE CLAY CAP INCLUDED IN ALTERNATIVE 4 WOULD DECREASE INFILTRATION TO LESS THAN 10 PERCENT OF PRECIPITATION. WITH RESPECT TO THE FLOOD PROTECTION DIKE, THE LANDFILL'S NORTH SIDE APPEARS TO BE STABLE UNDER CURRENT CONDITIONS. IT SHOULD BE POSSIBLE TO INSTALL A NEW LANDFILL COVER THAT WILL RESIST FLOOD DAMAGE WITHOUT THE ADDED EXPENSE OF A FLOOD PROTECTION DIKE.

US EPA HAS MADE MINOR REVISIONS TO REMEDIAL ALTERNATIVES BASED ON COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD. AS A RESULT, COSTS MAY BE SLIGHTLY HIGHER THAN THE ESTIMATES PRESENTED IN THIS SECTION.

9.8 STATE ACCEPTANCE

THE STATE OF OHIO HAS CONCURRED WITH US EPA'S SELECTION OF ALTERNATIVE 4 AS THE PREFERRED REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL. A LETTER OF CONCURRENCE IS ATTACHED TO THIS RECORD OF DECISION.

9.9 COMMUNITY ACCEPTANCE

US EPA'S PREFERRED REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL WAS PRESENTED AT THE START OF THE PUBLIC COMMENT PERIOD THROUGH DISTRIBUTION OF A FACT SHEET, PUBLICATION OF DISPLAY ADVERTISEMENTS IN THE CIRCLEVILLE, OHIO, HERALD, AND PLACEMENT OF THE PROPOSED PLAN IN THE SITE INFORMATION REPOSITORIES. A FORMAL PUBLIC MEETING TO DISCUSS THE PROPOSED PLAN WAS HELD IN CIRCLEVILLE ON FEBRUARY 28, 1989. COMMENTS RECEIVED INDICATE THAT MANY RESIDENTS ARE CONCERNED ABOUT US EPA'S PREFERRED ALTERNATIVE.

THESE COMMENTS FOCUS ON THREE GENERAL AREAS. FIRST, SEVERAL RESIDENTS COMMENTED THAT US EPA APPEARS TO BE CLOSING BOWERS LANDFILL AS A SOLID WASTE LANDFILL, WITH NO CONSIDERATION OF THE HAZARDOUS WASTES THAT WERE DISPOSED OF AT THE SITE. THESE RESIDENTS PREFER ALTERNATIVES 7 AND 8, WHICH INCLUDE ADDITIONAL PROTECTIVE MEASURES SUCH AS A SYNTHETIC LINER (IN ADDITION TO THE CLAY CAP) AND A FLOOD PROTECTION DIKE. US EPA HAS POINTED OUT IN THIS DECISION SUMMARY THAT RELEVANT AND APPROPRIATE PORTIONS OF HAZARDOUS WASTE REGULATIONS IN RCRA SUBTITLE C HAVE BEEN ADEQUATELY CONSIDERED IN THE DESIGN AND SELECTION OF ALTERNATIVE 4. THIS ISSUE IS DISCUSSED FURTHER IN THE RESPONSIVENESS SUMMARY.

SECOND, SEVERAL RESIDENTS EXPRESSED CONCERN ABOUT US EPA'S PROPOSED GROUND-WATER MONITORING PLAN FOR BOWERS LANDFILL. THESE CONCERNS ARE DIRECTLY RELATED TO PROTECTION OF PUBLIC DRINKING WATER SUPPLIES - SPECIFICALLY, THE CITY OF CIRCLEVILLE'S WELLFIELD LOCATED 1 1/2 MILES SOUTH OF THE LANDFILL. TO ADDRESS THESE CONCERNS, THE GROUND-WATER MONITORING PROGRAM WILL INCLUDE INSTALLING AND SAMPLING ADDITIONAL MONITORING WELLS SOUTH OF BOWERS LANDFILL. FURTHER, US EPA WILL REQUIRE THAT CORRECTIVE ACTION PROGRAM OPTIONS BE DEVELOPED AS PART OF THE MONITORING PROGRAM. THIS WILL ALLOW PROMPT RESPONSE IF GROUND-WATER CONTAMINANT LEVELS EXCEED LEVELS OF CONCERN AT ANY COMPLIANCE POINT IN THE MONITORING SYSTEM.

FINALLY, SEVERAL RESIDENTS EXPRESSED CONCERN THAT US EPA'S PREFERRED ALTERNATIVE REPRESENTS A CONCEPTUAL DESIGN, SPECIFIC ELEMENTS OF WHICH WILL BE DETERMINED LATER WITH LIMITED INPUT FROM LOCAL RESIDENTS. TO ADDRESS THIS CONCERN, US EPA WILL CONSIDER EXTENDING THE BOWERS LANDFILL INFORMATION COMMITTEE (SEE SECTION 3.0) THROUGH THE REMEDIAL DESIGN/REMEDIAL ACTION PHASE OF THIS PROJECT.

#TSR

10.0 THE SELECTED REMEDY

AFTER EVALUATING ALL THE FEASIBLE ALTERNATIVES, US EPA IS SELECTING A REMEDY THAT CONSISTS OF FIVE COMPONENTS: (1) GROUND-WATER MONITORING; (2) SITE ACCESS RESTRICTIONS; (3) MANAGEMENT OF SURFACE DEBRIS; (4) EROSION CONTROL AND DRAINAGE IMPROVEMENTS; AND (5) A NATURAL CLAY COVER OVER THE LANDFILL. THESE FIVE COMPONENTS ARE DESCRIBED IN DETAIL BELOW.

10.1 GROUND-WATER MONITORING

UNDER ALTERNATIVE 4, A LONG-TERM PROGRAM WILL BE IMPLEMENTED TO MONITOR CONTAMINANT CONCENTRATIONS AND MIGRATION. THIS PROGRAM WILL INCLUDE INSTALLING ADDITIONAL MONITORING WELLS SOUTH OF BOWERS LANDFILL (BETWEEN THE LANDFILL AND THE CIRCLEVILLE MUNICIPAL WELLFIELD) AND WEST OF THE LANDFILL (BETWEEN THE LANDFILL AND THE SCIOTO RIVER). THESE NEW WELLS, EXISTING MONITORING WELLS, AND POSSIBLY RESIDENTIAL WELLS NEAR THE LANDFILL WILL BE SAMPLED REGULARLY. AT A MINIMUM, THE PROGRAM WILL MEET THE SUBSTANTIVE REQUIREMENTS FOR GROUND-WATER MONITORING UNDER RCRA AS DESCRIBED IN 40 CFR 264, SUBPART F.

THE INSTALLATION OF THREE ADDITIONAL GROUND-WATER MONITORING WELL CLUSTERS IS NECESSARY TO DEVELOP A GROUND-WATER MONITORING PROGRAM THAT WILL ADEQUATELY DETECT POTENTIAL FUTURE RELEASES OF CONTAMINANTS. THESE WELL CLUSTERS WILL CONSIST OF THREE WELLS; A SHALLOW WELL THAT WILL BE LOCATED IN THE UPPER PORTION OF THE SATURATED ALLUVIAL, AN INTERMEDIATE WELL THAT WILL BE LOCATED BETWEEN THE WATER TABLE AND THE BEDROCK, AND A DEEP WELL THAT WILL BE LOCATED JUST ABOVE THE BEDROCK. TWO OF THESE WELL CLUSTERS WILL BE INSTALLED WEST OF THE LANDFILL. ONE CLUSTER WILL BE INSTALLED BETWEEN WELL LOCATION 5 AND WELL LOCATION 6 AND THE OTHER BETWEEN WELL W-10 AND THE BEND OF THE LANDFILL (SEE FIGURE 3). THE THIRD WELL CLUSTER WILL BE INSTALLED OFF-SITE BETWEEN THE LANDFILL AND THE CIRCLEVILLE MUNICIPAL WELLFIELD. THE INSTALLATION OF WELL CLUSTERS IN ADDITION TO THESE MAY ALSO BE CONSIDERED.

THE MONITORING WELLS WILL BE SAMPLED ON A BIMONTHLY BASIS FOR THE FIRST YEAR AND QUARTERLY FOR YEARS 2 THROUGH 4. DURING THE FIRST YEAR, SAMPLES WILL BE ANALYZED FOR THE FULL TARGET COMPOUND LIST (TCL). A REDUCED TCL MAY BE CONSIDERED AFTER THE FIRST YEAR. IF THE LEVELS OF CONTAMINANTS IN GROUND WATER DO NOT

INCREASE OVER THIS TIME PERIOD, THE SAMPLING SCHEDULE WILL BE REEVALUATED AND A REDUCTION IN THE FREQUENCY OF SAMPLING MAY BE CONSIDERED. A STATISTICAL TEST WILL BE DEVELOPED TO DETERMINE WHEN A SIGNIFICANT INCREASE IN THE LEVEL OF CONTAMINANTS HAS OCCURRED.

SHOULD A SIGNIFICANT INCREASE IN THE LEVELS OF CONTAMINANTS OCCUR, IT WILL AUTOMATICALLY TRIGGER A RCRA CORRECTIVE ACTION. IF THE LEVELS OF CONTAMINANTS IN GROUND WATER EXCEED MCLS, WHERE AVAILABLE, OR HEALTH-BASED LEVELS, WHERE MCLS ARE NOT AVAILABLE, RESAMPLING WILL OCCUR WITHIN 14 DAYS. (HEALTH-BASED LEVELS ARE CONCENTRATIONS CORRESPONDING TO A CANCER RISK OF 10^{-6} FOR CARCINOGENIC CONTAMINANTS AND A HAZARD INDEX (HI) GREATER THAN 1 FOR NONCARCINOGENIC CONTAMINANTS.) IF THE RESAMPLING VERIFIES THAT THERE HAS BEEN A SIGNIFICANT INCREASE IN CONTAMINANT LEVELS, A CORRECTIVE ACTION PROGRAM WILL BE IMPLEMENTED. CORRECTIVE ACTION MAY INCLUDE SUCH MEASURES AS ESTABLISHING ALTERNATIVE CONCENTRATION LIMITS (ACLS), COLLECTING AND TREATING GROUND WATER, OR REMOVING THE SOURCE OF CONTAMINATION.

THE SURFACE WATER IN THE DRAINAGE DITCH TO THE EAST OF THE LANDFILL WILL BE SAMPLED ON A QUARTERLY BASIS AS PART OF THE MONITORING PROGRAM. MONITORING WILL VERIFY THAT DISCHARGES FROM THE DITCH ARE IN COMPLIANCE WITH OHIO WATER QUALITY STANDARDS, AS DESCRIBED IN THE OHIO ADMINISTRATIVE CODE (OAC) 3745-01. A CORRECTIVE ACTION PROGRAM WILL BE IMPLEMENTED IF CONTAMINANT LEVELS IN THE DITCH EXCEED THESE STANDARDS.

10.2 SITE ACCESS RESTRICTIONS

EFFORTS WILL BE MADE TO PROCURE DEED RESTRICTIONS PROHIBITING GROUND-WATER EXTRACTION IN THE FIELD WEST OF THE LANDFILL AND RESTRICTING DISTURBANCE OF THE LANDFILL SURFACE. THE VIABILITY OF CONTINUED FARMING IMMEDIATELY WEST OF THE LANDFILL WILL BE EVALUATED, AND, IF SHOWN TO BE NECESSARY, EFFORTS WOULD BE MADE TO PROHIBIT SUCH FARMING BY IMPOSITION OF DEED RESTRICTIONS. A 6-FOOT FENCE WILL BE PLACED AROUND THE LANDFILL, THE DRAINAGE DITCH TO THE EAST, AND THE FIELD TO THE WEST TO LIMIT SITE ACCESS. THE LOCATION OF THE FENCE IS SHOWN ON FIGURE 6.

10.3 MANAGEMENT OF SURFACE DEBRIS

THE LANDFILL AREA AND ITS IMMEDIATE VICINITY WILL BE CLEARED OF SURFACE DEBRIS. MOST OF THE CURRENTLY EXPOSED MATERIAL CONSISTS OF SHREDDED OR ROLLED PLASTIC FILM, BUT RUSTED AND PARTIALLY DECOMPOSED REMAINS OF APPLIANCES, DISCARDED TIRES, DOMESTIC WASTE, AND EMPTY DRUMS ARE ALSO EVIDENT. THE VISIBLE WASTE ITEMS WILL BE REMOVED FROM THE SITE BY A FRONT-END LOADER, PLACED IN A LINED TRUCK, AND TRANSPORTED TO A SUITABLE HAZARDOUS WASTE LANDFILL. IF THE DEBRIS IS DETERMINED TO BE NONHAZARDOUS, IT WILL BE DISPOSED OF IN A SOLID WASTE LANDFILL.

TREES ON THE LANDFILL WILL BE CUT DOWN WITH CHAIN SAWS, AND TREE STUMPS WILL BE GROUND DOWN TO THE LAND SURFACE. SMALLER VEGETATION, LESS THAN 2 FEET IN DIAMETER, WILL BE CUT DOWN WITH MECHANICAL EQUIPMENT SUCH AS BUSH HOGS. AS MUCH SUBSURFACE VEGETATION AS FEASIBLE WILL BE REMOVED, WITHOUT EXPOSING SIGNIFICANT AMOUNTS OF WASTE. EXPOSED COVER WILL BE TREATED AS NECESSARY TO PREVENT TREE GROWTH THROUGH THE NEW COVER. ALL VEGETATIVE MATERIAL WILL BE HAULED TO A LOCAL LANDFILL UNLESS TISSUE SAMPLES INDICATE THAT MATERIALS ARE POTENTIALLY HAZARDOUS. IF POTENTIALLY HAZARDOUS, THIS MATERIAL WILL BE DISPOSED OF IN AN APPROVED OFF-SITE HAZARDOUS WASTE DISPOSAL FACILITY.

10.4 EROSION CONTROL AND DRAINAGE IMPROVEMENTS

EROSION CONTROL WILL BE PROVIDED FOR THOSE AREAS OF THE LANDFILL PRONE TO THE SCOURING EFFECTS OF FLOOD WATERS. THE AREAS MOST LIKELY TO BE SUBJECTED TO THESE EFFECTS ARE THE NORTHWEST AND SOUTHEAST PORTIONS OF THE LANDFILL THAT ABUT THE SCIOTO RIVER. A SYSTEM OF ARMOR STONE (RIPRAP) WILL BE USED IN THESE AREAS TO SUPPLEMENT THE EROSION RESISTANCE PROVIDED BY THE NEW COVER. THIS RIPRAP WILL BE PLACED ON THE LANDFILL IN AREAS SHOWN ON FIGURE 6. IF RIPRAP CANNOT BE EFFECTIVELY PLACED ON STEEPER SLOPES, SHEET PILING WILL BE USED TO ANCHOR THE RIPRAP. IF SHEET PILING PROVES INEFFECTIVE, A CONCRETE WALL MAY BE USED.

SITE DRAINAGE WILL BE IMPROVED TO PREVENT PONDING OF WATER AGAINST THE LANDFILL. THE AREA BETWEEN THE LANDFILL AND THE RIVER WILL BE REGRADED TO ALLOW WATER TO DRAIN AWAY FROM THE LANDFILL. THE SITE WILL ALSO BE REGRADED TO ALLOW FOR DRAINAGE FLOW FROM NORTH TO SOUTH TO THE RIVER.

THE DRAINAGE DITCH ON THE EASTERN SIDE OF THE LANDFILL WILL ALSO BE IMPROVED. WHERE NECESSARY, SIDE SLOPES WILL BE IMPROVED TO PREVENT EROSION. THE HIGH POINT BETWEEN THE NORTH END OF THIS DITCH AND THE OPEN FIELD NORTH OF THE LANDFILL WILL BE CUT DOWN TO PREVENT PONDING OF WATER AGAINST THE NORTHERN PART OF THE LANDFILL DURING HIGH-WATER CONDITIONS. HIGH POINTS WITHIN THE DITCH WILL ALSO BE CUT DOWN TO ALLOW WATER TO DRAIN THROUGH THE DITCH. SEDIMENTS REMOVED DURING THIS PROCESS, AND POSSIBLY OTHER CONTAMINATED SEDIMENTS, COULD BE DEWATERED AS NECESSARY AND PLACED ON THE LANDFILL SURFACE PRIOR TO INSTALLING THE CLAY CAP. REMOVAL OF CONTAMINATED SEDIMENTS WILL REDUCE THE POSSIBILITY OF CONTAMINATED SURFACE WATER DISCHARGES FROM THE DITCH TO THE SCIOTO RIVER. THE DISCHARGE PIPE AT THE SOUTHERN END OF THE DRAINAGE DITCH WILL BE PLACED UNDER THE SOUTHERN END OF THE LANDFILL AND WILL DISCHARGE TO THE RIVER. THE POINT WHERE THE DITCH MEETS THE PIPE WILL BE LINED WITH COMPACTED CLAY AND REINFORCED WITH RIPRAP. THE PIPE WILL HAVE A 2 PERCENT SLOPE TO PREVENT BLOCKAGE WITH SEDIMENTS.

10.5 NATURAL CLAY COVER OVER LANDFILL

PRIOR TO CONSTRUCTION OF THE LANDFILL COVER, A DETAILED GEOTECHNICAL INVESTIGATION WILL BE CONDUCTED TO MEASURE THE PROPERTIES OF THE EXISTING LANDFILL SURFACE AND OF SOIL AND CLAY USED FOR THE COVER. THE PURPOSE OF THIS INVESTIGATION WILL BE TO DETERMINE THE STABILITY OF THESE MATERIALS UNDER FLOOD CONDITIONS. THE COVER WILL THEN BE CONSTRUCTED WITH SIDE SLOPES FLAT ENOUGH TO PROVIDE ADEQUATE STABILITY WHEN THE SCIOTO RIVER FLOODS. ALTHOUGH THERE IS NO APPARENT NEED FOR A LANDFILL GAS COLLECTION SYSTEM, THIS DETERMINATION COULD BE REEVALUATED AS PART OF THE GEOTECHNICAL INVESTIGATION. A SOIL GAS STUDY OF THE LANDFILL COULD VERIFY THAT VOCs ARE NOT PRESENT IN SUFFICIENT QUANTITIES TO WARRANT COLLECTION.

THE LANDFILL COVER WILL BE CONSTRUCTED IN SEGMENTS TO MINIMIZE POTENTIAL DAMAGE DUE TO FLOODING DURING CONSTRUCTION. WORK ON ONE AREA OF THE LANDFILL WILL BE COMPLETED BEFORE CONSTRUCTION OF THE NEXT AREA BEGINS. AFTER EACH LANDFILL SEGMENT HAS BEEN PREPARED, A WELL COMPACTED CLAY LAYER, AT LEAST 24 INCHES THICK, WILL BE PLACED ON THE LANDFILL CAP AND SIDE SLOPES. THE CLAY WILL BE ADDED IN LIFTS, NOT EXCEEDING 6-INCHES, AND COMPACTED BEFORE MORE CLAY IS ADDED. THE CLAY LAYER WILL HAVE A MAXIMUM PERMEABILITY OF 10^{-7} CM/SEC. EACH LIFT WILL BE TESTED ACCORDING TO A STRINGENT QUALITY ASSURANCE PROGRAM TO VERIFY THAT THIS SPECIFICATION IS MET.

A TOP SOIL LAYER AT LEAST 24 INCHES THICK WILL BE PLACED OVER THE CLAY LAYER (FIGURE 7). THIS LAYER WILL ALSO BE APPLIED AND COMPACTED IN 6-INCH LIFTS. THE FINAL COVER WILL HAVE SUFFICIENT HORIZONTAL-TO-VERTICAL SIDE SLOPES SO AS TO PREVENT FAILURE DURING WORST CASE FLOODING CONDITIONS. THE ENTIRE SURFACE OF THE COMPLETED COVER WILL BE RESEED, FERTILIZED, AND WATERED TO ASSURE PLANT GROWTH. THE PLANT SPECIES USED WILL HAVE ROOT SYSTEMS THAT ARE NOT EXPECTED TO PENETRATE BELOW THE UPPER 24 INCHES OF COVER.

THE COVER WILL BE INSPECTED AND MAINTAINED ON A QUARTERLY BASIS. THE MAINTENANCE PROGRAM WILL INCLUDE REGULARLY MOWING THE VEGETATION ON THE CAP; INSPECTING THE SURFACE FOR CRACKS, SETTLEMENT, PONDING, AND EROSION; COMPLETING APPROPRIATE REPAIRS TO THE CAP; AND REPAIRING THE FENCE. REPAIRS TO ALL SIGNIFICANT DAMAGE WILL BEGIN WITHIN 30 DAYS. IN ADDITION TO REGULARLY SCHEDULED INSPECTIONS, WILL BE MADE AFTER FLOOD EVENTS.

THE LANDFILL WILL ALSO BE INSPECTED FOR LEACHATE AND METHANE GAS PRODUCTION ON A QUARTERLY BASIS. IF LEACHATE PRODUCTION OCCURS THAT COULD POTENTIALLY ADVERSELY AFFECT PUBLIC HEALTH OR THE ENVIRONMENT, A LEACHATE COLLECTION SYSTEM WILL BE INSTALLED AND THE LEACHATE WILL BE COLLECTED AND TREATED. IF METHANE GAS PRODUCTION OCCURS THAT COULD POTENTIALLY ADVERSELY AFFECT PUBLIC HEALTH OR THE ENVIRONMENT, A GAS VENTING SYSTEM WILL BE INSTALLED.

10.6 REDUCTION OF SITE RISKS

THE SELECTED REMEDY ADDRESSES THE MAJOR RISKS FOR BOWERS LANDFILL AS IDENTIFIED IN THE EA. RISKS FROM INGESTING CONTAMINATED SOILS WILL BE REDUCED BY COVERING THE LANDFILL (THUS COVERING MOST HIGHLY CONTAMINATED SOILS) AND BY RESTRICTING ACCESS TO THE SITE. SOILS IN THE FIELD WEST OF THE LANDFILL THAT CONTAIN LESSER AMOUNTS OF CONTAMINATION WILL NOT BE COVERED. THE RESIDUAL RISKS FROM INGESTING THESE SOILS INCLUDE AN INSIGNIFICANT NONCARCINOGENIC RISK (HI OF 0.24) AND A CARCINOGENIC RISK OF 4×10^{-8} . RISKS FROM INGESTING CONTAMINATED GROUND WATER IMMEDIATELY DOWNGRAIENT OF THE LANDFILL WILL BE REDUCED TO ZERO BY FUTURE GROUND-WATER USE RESTRICTIONS.

ALTERNATIVE 4 ALSO REDUCES POTENTIAL LONG-TERM RISKS ASSOCIATED WITH THE LANDFILL. THE LOW-PERMEABILITY CLAY COVER WILL GREATLY REDUCE INFILTRATION OF PRECIPITATION AND FLOOD WATERS, COMPARED TO THE CURRENT COVER. THUS, THE MOBILITY OF CONTAMINANTS REMAINING THE LANDFILL WILL BE REDUCED. THE COVER WILL ISOLATE WASTE WITHIN BOWERS LANDFILL UNDER A MINIMUM 4-FOOT THICKNESS OF COVER MATERIAL AND WILL BE DESIGNED TO PROVIDE LONG-TERM STABILITY DURING FLOODS.

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11.0 STATUTORY DETERMINATIONS

THE REMEDIAL ACTION SELECTED FOR IMPLEMENTATION AT THE BOWERS LANDFILL SITE SATISFIES THE STATUTORY REQUIREMENTS OF CERCLA SECTION 121. THE SELECTED REMEDY IS CONSISTENT WITH THE NCP, PROTECTS HUMAN HEALTH AND ENVIRONMENT, ATTAINS ARARS, AND IS COST-EFFECTIVE. THE SELECTED REMEDY DOES NOT SATISFY THE STATUTORY PREFERENCE FOR A PERMANENT SOLUTION IN THAT IT LEAVES UNTREATED WASTE ON-SITE. NOR DOES THE SELECTED REMEDY REDUCE THE TOXICITY OR VOLUME OF WASTES. HOWEVER, SOURCE CONTROL AND CONTAINMENT COMPONENTS OF THE SELECTED REMEDY SHOULD SIGNIFICANTLY REDUCE THE MOBILITY OF CONTAMINANTS FROM THE LANDFILL.

11.1 THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT

THE REMEDIAL ALTERNATIVE SELECTED FOR BOWERS LANDFILL WILL REDUCE CURRENT AND POTENTIAL FUTURE RISKS TO HUMAN HEALTH AND THE ENVIRONMENT BY THE FOLLOWING MEANS:

- * PREVENTING EXPOSURE TO CONTAMINATED SOILS BY COVERING CONTAMINATED SOILS WITH A 4-FOOT THICK IMPERMEABLE CLAY AND SOIL CAP AND BY FENCING THE SITE AREA. THE CAP AND FENCE WILL BE MAINTAINED ON A REGULAR BASIS, WITH AN INCREASED INSPECTION SCHEDULE DURING FLOODS.
- * PREVENTING EXPOSURE TO CONTAMINATED GROUND WATER BY RESTRICTING ACCESS TO DOWNGRAIDENT PROPERTY. EFFORTS WILL BE MADE TO OBTAIN DEED RESTRICTIONS TO PROHIBIT EXTRACTION AND USE OF GROUND WATER FROM THIS AREA.
- * LIMITING FUTURE GROUND-WATER CONTAMINATION BY REDUCING INFILTRATION THROUGH CONTAMINATED SOILS AND THE LANDFILL. THE EFFECTIVENESS OF THE COVER WILL BE EVALUATED BY A LONG-TERM GROUND-WATER MONITORING PROGRAM. THE PROGRAM WILL REQUIRE REGULAR AND SYSTEMATIC SAMPLING OF MONITORING WELLS WEST AND SOUTH OF THE LANDFILL AND POSSIBLY FROM RESIDENTIAL WELLS SOUTH OF THE LANDFILL.
- * REDUCING POTENTIAL FUTURE EXPOSURE TO WASTES IN BOWERS LANDFILL BY CONSTRUCTING A STABLE COVER DESIGNED TO WITHSTAND FREQUENT FLOODING OF THE SCIOTO RIVER.
- * REDUCING POTENTIAL SOURCES OF SURFACE WATER CONTAMINATION FOR THE SCIOTO RIVER BY REMOVING CONTAMINATED SEDIMENTS FROM THE DRAINAGE DITCH THAT IS CONTIGUOUS WITH THE EAST SIDE OF BOWERS LANDFILL. DISCHARGES FROM THE DRAINAGE DITCH WILL BE MONITORED FOR COMPLIANCE WITH OHIO WATER QUALITY STANDARDS.

11.2 THE SELECTED REMEDY ATTAINS ARARS

THE SELECTED REMEDY WILL MEET OR ATTAIN ALL APPLICABLE OR RELEVANT AND APPROPRIATE FEDERAL AND STATE REQUIREMENTS. THESE REQUIREMENTS INCLUDE:

- * OHIO REQUIREMENTS FOR THE CLOSURE OF SOLID WASTE LANDFILLS (OAC 3745-27-09 AND OAC 3745-27-10). THE FINAL LANDFILL COVER WILL EXCEED THE REQUIRED THICKNESS OF 2 FEET AND WILL MEET ALL OTHER SUBSTANTIVE REQUIREMENTS WITHIN THESE REGULATIONS.
- * RELEVANT AND APPROPRIATE PORTIONS OF RCRA REQUIREMENTS FOR CLOSURE OF HAZARDOUS WASTE LANDFILL WITH WASTES IN PLACE. THE LOW-PERMEABILITY CLAY LAYER (MAXIMUM OF 10-7 CM/SEC). WILL COMPLY WITH PORTIONS OF THE COVER REQUIREMENTS IN 40 CFR 264.301. THE GROUND-WATER MONITORING PROGRAM WILL MEET THE SUBSTANTIVE REQUIREMENTS OF 40 CFR 264, SUBPART F. THE PROGRAM WILL INCLUDE A CORRECTIVE ACTION COMPONENT THAT WILL BE TRIGGERED IF GROUND-WATER PROTECTION STANDARDS ARE EXCEEDED AT ANY POINT OF COMPLIANCE IN THE MONITORING SYSTEM.
- * US EPA REQUIREMENTS FOR FLOODPLAIN PROTECTION, AS DESCRIBED IN 40 CFR 6, APPENDIX A, STATEMENT OF PROCEDURES ON FLOODPLAIN MANAGEMENT AND WETLANDS PROTECTION. THIS REGULATION REQUIRES THAT CONSTRUCTION IN FLOODPLAINS BE DONE IN SUCH A MANNER AS TO MINIMIZE HARM TO THE FLOODPLAIN. CONSTRUCTION WITHIN THE SCIOTO RIVER FLOODPLAIN IS UNAVOIDABLE IN IMPLEMENTING A REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL.
- * RCRA REQUIREMENTS FOR CONSTRUCTION, OPERATION, AND MAINTENANCE OF HAZARDOUS WASTE LANDFILLS IN 100-YEAR FLOODPLAINS. THE COVER INSTALLED DURING REMEDIAL ACTION WILL BE DESIGNED AND ENGINEERED TO PREVENT WASHOUT OF ANY HAZARDOUS WASTES BY A 100-YEAR FLOOD, AS REQUIRED BY RCRA GENERAL FACILITY STANDARDS IN 40 CFR 264.18.
- * MAXIMUM CONTAMINANT LEVELS (MCL) PROMULGATED UNDER THE SAFE DRINKING WATER ACT. MCLS APPLY TO PUBLIC DRINKING WATER SUPPLIES SERVING 25 OR MORE PEOPLE. WHILE NOT APPLICABLE TO GROUND WATER IMMEDIATELY DOWNGRAIENT OF BOWERS LANDFILL, MCLS ARE RELEVANT AND APPROPRIATE FOR ASSESSING GROUND-WATER CONTAMINATION LEVELS. CURRENT CONTAMINANT LEVELS EXCEED MCLS IN TWO MONITORING WELLS - BENZENE IN ONE WELL AND BARIUM IS A SECOND WELL. HOWEVER, AVERAGE GROUND-WATER CONCENTRATIONS WERE WELL BELOW MCLS. BY REDUCING INFILTRATION OF PRECIPITATION AND FLOOD WATERS THROUGH THE LANDFILL, ALTERNATIVE 4 SHOULD EVENTUALLY REDUCE CONTAMINANT CONCENTRATIONS BELOW THE MCLS IN ALL DOWNGRAIENT WELLS.
- * OHIO WATER QUALITY STANDARDS LISTED IN OAC 3745-01. DISCHARGES TO THE SCIOTO RIVER FROM THE DRAINAGE DITCH EAST OF THE LANDFILL WILL BE MONITORED TO VERIFY COMPLIANCE WITH THESE STANDARDS.

11.3 THE SELECTED REMEDY IS COST-EFFECTIVE

ALTERNATIVE 4 REPRESENTS A COST-EFFECTIVE REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL. THIS ALTERNATIVE ATTAINS THE SAME REDUCTIONS IN CURRENT RISKS FROM SOIL INGESTION AND GROUND-WATER INGESTION AS ALTERNATIVES 5 THROUGH 8, WHICH ARE CONSIDERABLY MORE EXPENSIVE. ALTERNATIVE 4 ALSO PROVIDES AN ADEQUATE DEGREE OF LONG-TERM PROTECTION, COMPARED TO THESE MORE EXPENSIVE ALTERNATIVES. ALTHOUGH ALTERNATIVES 5 THROUGH 8 MAY OFFER SLIGHTLY INCREASED LONG-TERM PROTECTION, THE RELATIVE COST INCREASES OUTWEIGH THE EXPECTED BENEFITS. ADDITIONAL COMPONENTS OF THESE ALTERNATIVES, SUCH AS A GAS VENTING SYSTEM, LEACHATE COLLECTION SYSTEM, SYNTHETIC MEMBRANE CAP, OR FLOOD PROTECTION DIKE, DO NOT INCREASE THE EFFECTIVENESS OF THESE ALTERNATIVES IN PROPORTION TO THE INCREASED COSTS. THESE ADDITIONAL MEASURES ARE NOT JUSTIFIED BASED ON CURRENT SITE CONDITIONS AND CONTAMINATION LEVELS.

ALTERNATIVE 4 HAS A HIGHER COST THAN ALTERNATIVES 3 AND 9. HOWEVER, THESE ALTERNATIVES DO NOT ACHIEVE EITHER THE SHORT-TERM RISK REDUCTIONS OR LONG-TERM PROTECTION OFFERED BY ALTERNATIVE 4. BY PROVIDING A DEGREE OF PROTECTION THAT CANNOT BE ACHIEVED BY LESS COSTLY MEANS, ALTERNATIVE 4 IS COST-EFFECTIVE.

11.4 THE SELECTED REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

ALTERNATIVE 4 IS NOT A PERMANENT SOLUTION TO THE PUBLIC HEALTH AND ENVIRONMENTAL PROBLEMS IDENTIFIED FOR BOWERS LANDFILL DURING THE RI. IT WAS NOT TECHNICALLY FEASIBLE TO DEVELOP A PERMANENT REMEDY FOR THIS SITE FOR SEVERAL REASONS. FIRST, MOST OF THE MATERIAL IN BOWERS LANDFILL CONSISTS OF GENERAL REFUSE AND MUNICIPAL SOLID WASTE. ALTHOUGH THE EXACT AMOUNT OF HAZARDOUS WASTE PLACED IN THE LANDFILL IS NOT KNOWN, IT IS PROBABLY A SMALL PERCENTAGE OF THE TOTAL WASTE VOLUME. SECOND, NO OPERATING RECORDS EXIST FOR THE LANDFILL. THUS, IT IS NOT FEASIBLE TO IDENTIFY LOCATIONS WHERE HAZARDOUS WASTES MIGHT HAVE BEEN PLACED. THIRD, THE RELATIVELY LOW LEVELS OF CONTAMINATION FOUND DURING THE RI WOULD NOT BE EFFECTIVELY REDUCED BY TREATMENT.

BECAUSE THE SELECTED ALTERNATIVE IS NOT A PERMANENT SOLUTION AND WILL LEAVE WASTES IN PLACE AT THE BOWERS LANDFILL, THE EFFECTIVENESS OF THIS REMEDIAL ACTION MUST BE REVIEWED AT LEAST ONCE EVERY 5 YEARS.

11.5 THE SELECTED REMEDY REDUCES TOXICITY, MOBILITY, OR VOLUME OF WASTE AS A PRINCIPAL ELEMENT

ALTERNATIVE 4 WILL NOT REDUCE THE TOXICITY OR VOLUME OF CONTAMINANTS WITHIN BOWERS LANDFILL. HOWEVER, THIS ALTERNATIVE WILL REDUCE THE MOBILITY OF WASTE MATERIALS WITHIN THE LANDFILL. THE FS REPORT ESTIMATES THAT THE LOW-PERMEABILITY CLAY CAP INCLUDED IN THIS ALTERNATIVE WILL REDUCE DIRECT INFILTRATION INTO THE LANDFILL SURFACE BY OVER 90 PERCENT. THIS IS MUCH MORE EFFECTIVE THAN THE CURRENT SOIL AND VEGETATION COVER. REDUCING THE AMOUNT OF WATER THAT CONTACTS WASTE MATERIALS WITHIN THE LANDFILL SHOULD REDUCE THE MOBILITY OF THESE MATERIALS AND THE LIKELIHOOD OF FUTURE GROUND-WATER CONTAMINATION.

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**RESPONSIVENESS SUMMARY
BOWERS LANDFILL
CIRCLEVILLE, OHIO**

1.0 INTRODUCTION

THE US ENVIRONMENTAL PROTECTION AGENCY HELD A PUBLIC COMMENT PERIOD FROM FEBRUARY 14 TO MARCH 16, 1989, TO PROVIDE INTERESTED PARTIES AN OPPORTUNITY TO COMMENT ON THE AGENCY'S PROPOSED PLAN FOR BOWERS LANDFILL. THE PURPOSE OF THIS RESPONSIVENESS SUMMARY IS TO IDENTIFY MAJOR COMMENTS RAISED DURING THE PUBLIC COMMENT PERIOD AND TO PROVIDE US EPA'S RESPONSES TO THESE COMMENTS. US EPA HAS CONSIDERED ALL COMMENTS SUMMARIZED IN THIS DOCUMENT BEFORE SELECTING A REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL.

THE RESPONSIVENESS SUMMARY INCLUDES FIVE SECTIONS PLUS THREE APPENDICES. SECTION 2.0 BRIEFLY STATES PUBLIC REACTION TO US EPA'S PROPOSED PLAN. SECTION 3.0 CONTAINS A BRIEF HISTORY OF COMMUNITY INTEREST AND INVOLVEMENT WITH THE BOWERS LANDFILL SITE. SECTION 4.0 SUMMARIZES WRITTEN AND ORAL COMMENTS RECEIVED BY US EPA DURING THE PUBLIC COMMENT PERIOD. COMMENTS WERE RECEIVED FROM LOCAL CITIZENS, ENVIRONMENTAL GROUPS, LOCAL OFFICIALS, STATE OFFICIALS, AND POTENTIALLY RESPONSIBLE PARTIES. SECTION 4.0 ALSO INCLUDES US EPA'S RESPONSE TO THESE COMMENTS. SECTION 5.0 IDENTIFIES AND SUMMARIZES ISSUES THAT MAY CONTINUE TO BE OF CONCERN TO THE COMMUNITY DURING THE DESIGN AND IMPLEMENTATION OF US EPA'S SELECTED REMEDY FOR BOWERS LANDFILL. US EPA WILL ADDRESS THESE CONCERNS DURING THE REMEDIAL DESIGN AND REMEDIAL ACTION (RD/RA) PHASE OF THE CLEANUP PROCESS.

THE FIRST ATTACHMENT TO THE RESPONSIVENESS SUMMARY IS A LIST OF COMMUNITY RELATIONS ACTIVITIES CONDUCTED BY US EPA AT BOWERS LANDFILL, BOTH BEFORE AND DURING THE PUBLIC COMMENT PERIOD. THE SECOND ATTACHMENT INCLUDES COPIES OF ALL WRITTEN COMMENTS ON THE PROPOSED PLAN RECEIVED DURING THE PUBLIC COMMENT PERIOD. ORAL COMMENTS, WHICH WERE RECORDED AT A PUBLIC MEETING ON FEBRUARY 28, 1989, ARE INCLUDED WITHIN THE TRANSCRIPT FOR THAT MEETING. THE TRANSCRIPT IS PART OF THE ADMINISTRATIVE RECORD FOR BOWERS LANDFILL.

2.0 OVERVIEW

US EPA'S PREFERRED ALTERNATIVE FOR THE BOWERS LANDFILL SITE WAS PRESENTED AT THE START OF THE PUBLIC COMMENT PERIOD THROUGH DISTRIBUTION OF A FACT SHEET, PUBLICATION OF DISPLAY ADVERTISEMENT IN THE CIRCLEVILLE HERALD, AND PLACEMENT OF THE FORMAL PROPOSED PLAN IN THE SITE INFORMATION REPOSITORIES. THE PROPOSED PLAN WAS ALSO PRESENTED AND DISCUSSED DURING A PUBLIC MEETING IN CIRCLEVILLE ON FEBRUARY 28, 1989. THE RECOMMENDED ALTERNATIVE ADDRESSED POTENTIAL GROUND-WATER CONTAMINATION PROBLEMS NEAR THE SITE, THE RISK OF INGESTING CONTAMINATED ON-SITE SOILS, AND LONG-TERM RISKS FROM FUTURE CONTAMINANT RELEASES.

THE PREFERRED ALTERNATIVE SPECIFIED IN THE PROPOSED PLAN CONSISTS OF MONITORING GROUND WATER AT AND NEAR THE SITE; RESTRICTING THE USE OF THE SITE SO THAT DRINKING WATER WELLS CANNOT BE PLACED BETWEEN THE SITE AND THE SCIOTO RIVER; PLACING A 6-FOOT HIGH FENCE AROUND THE SITE PERIMETER TO PREVENT POTENTIAL TRESPASSERS FROM ENTERING THE SITE AREA; AND INSTALLING A NEW CLAY CAP ON THE LANDFILL TO MINIMIZE THE AMOUNT OF CONTAMINANTS THAT COULD POTENTIALLY BE CARRIED INTO THE GROUND WATER BENEATH THE SITE. EROSION CONTROL AND DRAINAGE IMPROVEMENTS WOULD BE MADE, AND RIPRAP AND SHEET PILING WOULD BE PLACED ON THE NORTH AND SOUTH ENDS OF THE LANDFILL TO IMPROVE FLOOD PROTECTION.

THE COMMENTS RECEIVED DURING THE COMMENT PERIOD INDICATED THAT RESIDENTS HAVE SOME CONCERNS ABOUT US EPA'S PREFERRED REMEDIAL ALTERNATIVE. SOME RESIDENTS FELT ADDITIONAL FLOOD PROTECTION MEASURES WERE NEEDED AT THE SITE. CONCERNS WERE ALSO RAISED REGARDING THE PROPOSED GROUND-WATER MONITORING PROGRAM AND RESPONSE CONTINGENCIES. SPECIFIC DETAILS OF SUCH A PROGRAM ARE USUALLY RESOLVED IN THE REMEDIAL DESIGN PHASE. SEVERAL RESIDENTS INDICATED CONCERN THAT THEY WOULD HAVE LIMITED FUTURE OPPORTUNITIES FOR INPUT INTO THE CLEANUP PROCESS AFTER THE RECORD OF DECISION (ROD) IS SIGNED. THESE RESIDENTS STRONGLY REQUESTED THE CONTINUATION OF THE BOWERS LANDFILL INFORMATION COMMITTEE (SEE SECTION 3.2).

ALL WRITTEN COMMENTS RECEIVED BY US EPA ARE INCLUDED IN APPENDIX A TO THIS RESPONSIVENESS SUMMARY. VERBAL COMMENTS RECORDED AT THE FEBRUARY 28, 1989, PUBLIC MEETING ARE CONTAINED IN THE TRANSCRIPT OF THAT MEETING, WHICH IS PART OF THE ADMINISTRATIVE RECORD FOR BOWERS LANDFILL.

3.0 BACKGROUND ON COMMUNITY INVOLVEMENT

3.1 EARLY INVOLVEMENT

COMMUNITY INTEREST IN BOWERS LANDFILL DATES BACK TO THE EARLY 1960S WHEN RESIDENTS COMPLAINED TO THE PICKAWAY COUNTY HEALTH DEPARTMENT ABOUT ODORS AND FIRES AT THE LANDFILL. SPORADIC COMPLAINTS FROM RESIDENTS CONTINUED THROUGHOUT THE 1960S AND 1970S.

LOCAL MEDIA COVERED THE SITE DURING THE EARLY 1980S AFTER SUPERFUND WAS ENACTED AND US EPA BECAME INVOLVED AT THE SITE. IN APRIL 1984, COLUMBUS TELEVISION STATION WMCH (CHANNEL 4) MISTAKENLY REPORTED THAT BOWERS LANDFILL WAS POSSIBLY CONTAMINATED WITH DIOXIN. THE REPORT RESULTED IN INCREASED INTEREST AND CONCERN ABOUT THE SITE. SINCE THAT TIME, COMMUNITY INTEREST AND INVOLVEMENT HAVE BEEN HIGH. THIS LEVEL OF INTEREST WAS MAINTAINED DURING THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS). APPENDIX B TO THIS RESPONSIVENESS SUMMARY LISTS COMMUNITY RELATIONS ACTIVITIES THAT US EPA HAS CONDUCTED IN RESPONSE TO THIS INTEREST.

IN EARLY 1985, A CONSENT ORDER, ALLOWING THE POTENTIALLY RESPONSIBLE PARTIES TO CONDUCT THE RI/FS, WAS DRAFTED. US EPA HELD A PUBLIC COMMENT PERIOD ON THE DRAFT CONSENT ORDER AND RECEIVED WRITTEN AND VERBAL COMMENTS COVERING A WIDE RANGE OF ENVIRONMENTAL HEALTH AND PUBLIC INVOLVEMENT ISSUES. US EPA RESPONDED TO THESE COMMENTS IN JULY 1985. THE DOCUMENT CONTAINING THESE RESPONSES (RESPONSE TO PUBLIC COMMENTS ON CONSENT ORDER FOR THE BOWERS LANDFILL, CIRCLEVILLE, OHIO, JULY 1985) IS INCLUDED AS APPENDIX C TO THIS RESPONSIVENESS SUMMARY.

MANY OF THE COMMENTS ON THE CONSENT ORDER INDICATED AN INTEREST IN GREATER COMMUNITY INVOLVEMENT DURING RI/FS PROCESS. RESIDENTS AND OFFICIALS WANTED TO BE KEPT WELL INFORMED. SOME WANTED REPRESENTATION IN THE DECISION-MAKING PROCESS. IN RESPONSE TO THESE COMMENTS, US EPA ESTABLISHED THE BOWERS LANDFILL INFORMATION COMMITTEE.

3.2 BOWERS LANDFILL INFORMATION COMMITTEE

THE BOWERS LANDFILL INFORMATION COMMITTEE WAS ESTABLISHED IN NOVEMBER 1985. THE COMMITTEE CONSISTED OF REPRESENTATIVES FROM US EPA, OEPA, THE PRPS, LOCAL (CITY AND COUNTY) GOVERNMENT, AND CITIZEN'S GROUPS (ACTION AND L-ECHOS). THE COMMITTEE MET REGULARLY TO DISCUSS PROGRESS DURING THE RI/FS AND UPCOMING EVENTS. DRAFT REPORTS WERE ALSO PROVIDED TO THE COMMITTEE FOR REVIEW AND DISCUSSION. COMMITTEE MEETINGS WERE OPEN TO ANY INTERESTED OBSERVERS. TWELVE MEETINGS WERE HELD BETWEEN NOVEMBER 1985 AND NOVEMBER 1988. THE COMMITTEE HAD SEVERAL MAJOR FUNCTIONS:

- * TO DISSEMINATE REPORTS, DATA, AND OTHER INFORMATION RELATED TO THE BOWERS LANDFILL RI/FS. DURING THE MEETING, US EPA, OEPA, AND THE PRPS MADE FORMAL PRESENTATIONS TO THE COMMITTEE ON TOPICS SUCH AS WELL INSTALLATION AND SAMPLING METHODS; SAMPLING RESULTS FOR SOIL, GROUND WATER, SURFACE WATER, AND SEDIMENT; ENDANGERMENT ASSESSMENT RESULTS; APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS); AND REMEDIAL ALTERNATIVES DEVELOPED IN THE FS.
- * TO ACT AS LIAISON BETWEEN THE AGENCIES AND THE REST OF THE COMMUNITY.
- * TO PROVIDE INPUT TO US EPA AND OEPA ON ISSUES RELATED TO THE SITE. HOWEVER, THE COMMITTEE WAS NOT A DECISION-MAKING BODY AND HAD NO AUTHORITY TO OVERRIDE AGENCY DECISIONS.

US EPA AND OEPA DISTRIBUTED DRAFT VERSIONS OF SEVERAL DOCUMENTS TO THE COMMITTEE FOR REVIEW AND DISCUSSION. THESE DOCUMENTS WERE GENERALLY DISTRIBUTED AT LEAST ONE WEEK (AND OFTEN EARLIER) BEFORE THE COMMITTEE MEETING AT WHICH THE DOCUMENT WAS TO BE DISCUSSED. SITE REPORTS REVIEWED AND DISCUSSED BY THE COMMITTEE INCLUDED:

- * WORK PLAN
- * QA/QC PLAN

* SITE SAFETY PLAN	* GEOPHYSICAL SURVEY REPORT
* BIOLOGICAL SURVEY REPORT	* TECHNICAL MEMORANDA FOR
* RI REPORT	SAMPLING RESULTS
* ENDANGERMENT ASSESSMENT REPORT	* ALTERNATIVES ARRAY DOCUMENT
* FS REPORT	

3.3 CONCERNS RAISED DURING THE RI/FS

THE FOLLOWING COMMUNITY CONCERNS WERE RAISED DURING THE RI/FS. MANY OF THESE CONCERNS WERE EXPRESSED BY THE MEMBERS OF THE BOWERS LANDFILL INFORMATION COMMITTEE.

1. CONCERNS WERE RAISED BY THE INFORMATION COMMITTEE ABOUT THE HEALTH AND SAFETY ASPECTS OF THE RI FIELD WORK. THE CONCERNS REGARDED COORDINATION BETWEEN AGENCIES, PRPS, AND LOCAL EMERGENCY OFFICIALS SHOULD AN EMERGENCY OCCUR.

US EPA RESPONSE: US EPA AND OEPA OFFICIALS MET WITH LOCAL FIRE, POLICE, HOSPITAL, AND OTHER OFFICIALS TO EXPLAIN THE ROLES OF THE RI PARTICIPANTS AND TO BETTER UNDERSTAND THE JURISDICTIONS AND RESPONSE CAPABILITIES OF THE LOCAL AGENCIES. RESPONSE PLANS WERE DEVELOPED FOR THE UNLIKELY EVENT OF AN EMERGENCY.

2. MEMBERS OF THE INFORMATION COMMITTEE EXPRESSED A DESIRE TO PHYSICALLY OBSERVE ON-SITE FIELD ACTIVITIES.

US EPA RESPONSE: DUE TO LIABILITY CONCERNS, THIS REQUEST WAS DENIED. HOWEVER, SLIDES TAKEN DURING RI FIELD ACTIVITIES WERE SHOWN AT INFORMATION COMMITTEE MEETINGS.

3. RESIDENTS EXPRESSED CONCERN THAT THE SITE SHOULD BE FENCED TO RESTRICT SITE ACCESS DURING RI FIELD ACTIVITIES.

US EPA RESPONSE: THE US EPA EMERGENCY RESPONSE TEAM EVALUATED BOWERS LANDFILL IN MAY 1985 TO DETERMINE WHETHER SITE ACCESS POSED AN IMMEDIATE HEALTH THREAT. US EPA DETERMINED THAT A FENCE WAS NOT NECESSARY BECAUSE THE ONLY UNNATURAL MATERIALS OBSERVED AT THE SITE WERE EMPTY DRUMS AND PLASTIC NONHAZARDOUS MATERIALS. THE SITE WAS ALMOST COMPLETELY COVERED BY VEGETATION (GRASSES, SHRUBS, AND TREES). HOWEVER, AS A RESULT OF THIS EVALUATION, US EPA INSTALLED ADDITIONAL WARNING SIGNS AT THE SITE, PARTICULARLY NEAR THE SOUTHERNMOST ACCESS POINT ALONG ISLAND ROAD.

BEFORE THE START OF THE RI FIELD WORK, A FENCED AREA WAS CONSTRUCTED NEAR THE ENTRANCE TO THE LANDFILL. EQUIPMENT USED DURING FIELD ACTIVITIES WAS STORED INSIDE THIS FENCED AREA WHEN NOT IN USE. THE AREA ALSO CONTAINED A SUPPORT TRAILER FOR FIELD ACTIVITIES.

4. CONCERNS WERE RAISED REGARDING THE DIFFERENCES BETWEEN THE RI RESULTS AND THE RESULTS OBTAINED BY BURGESS AND NIPLE IN 1981.

US EPA RESPONSE: US EPA BELIEVES THAT THE DATA OBTAINED DURING THE RI MOST ACCURATELY REPRESENTS CURRENT CONDITIONS AT AND NEAR THE LANDFILL. THE AGENCY ALSO FEELS THAT THE LEVEL OF DATA QUALITY ASSURANCE IN 1981 WAS NOT AS HIGH AS IS PRESENT QUALITY ASSURANCE PROGRAMS OFFER. THEREFORE, THE 1981 RESULTS MAY BE LESS RELIABLE THAN THE RI RESULTS. THE DIFFERENCES BETWEEN CURRENT AND 1981 RESULTS MAY ALSO BE EXPLAINED BY CHANGES IN CONTAMINANT LEVELS DUE TO FLOODING AT THE SITE OR VOLATILIZATION OF THE CHEMICALS. CHEMICALS THAT MIGRATE TO THE SCIOTO RIVER WOULD HAVE BEEN DILUTED TO MUCH LOWER CONCENTRATIONS. THE ISSUE IS ADDRESSED IN GREATER DETAIL IN SECTION 4.7 OF THIS RESPONSIVENESS SUMMARY.

5. US EPA WAS REQUESTED TO PROVIDE THE RESULTS OF PRIVATE WELL SAMPLING TO THE APPROPRIATE HOMEOWNERS.

US EPA RESPONSE: US EPA PROVIDED THE RESULTS OF WATER TESTING TO THE APPROPRIATE HOMEOWNERS. THE RESULTS WERE SENT TO THE INFORMATION REPOSITORY AND ARE ALSO INCLUDED IN THE RI AND EA REPORTS.

6. RESIDENTS WERE CONCERNED THAT THE CIRCLEVILLE WATER SUPPLY MIGHT BE CONTAMINATED.

US EPA RESPONSE: OEPA, A PARTY TO THE CONSENT ORDER, RESPONDED THAT THE CITY OF CIRCLEVILLE MUST

PERIODICALLY TEST ITS WATER SUPPLY FOR THE PRESENCE OF HAZARDOUS CHEMICALS. OEPA PLACED COPIES OF TEST RESULTS FROM 1980-1987 IN THE INFORMATION REPOSITORY.

SUMMARIES OF THESE TEST RESULTS ARE ALSO INCLUDED IN THE EA REPORT. THE RESULTS INDICATE THAT THE CIRCLEVILLE WATER SUPPLY IS OF HIGH QUALITY AND HAS NOT BEEN ADVERSELY AFFECTED BY CONTAMINATION FROM BOWERS LANDFILL. THIS ISSUE IS DISCUSSED FURTHER IN SECTIONS 4.2, 4.6, AND 4.7 OF THIS RESPONSIVENESS SUMMARY.

7. MEMBERS OF THE GROUP ACTION REQUESTED A FORMAL 90-DAY PUBLIC COMMENT PERIOD ON THE RI REPORT.

US EPA RESPONSE: WHILE A FORMAL COMMENT PERIOD ON THE BOWERS LANDFILL RI REPORT WAS NOT HELD, US EPA POINTED OUT THAT CITIZENS MAY COMMENT ON TECHNICAL ACTIVITIES AT ANY TIME DURING THE RI/FS PROCESS. ANY COMMENTS WOULD BE INCLUDED IN THE BOWERS LANDFILL ADMINISTRATIVE RECORD. IN ADDITION, COMMENTS ON THE RI SUBMITTED TO US EPA BY MEMBERS OF BOWERS LANDFILL INFORMATION COMMITTEE WERE INCLUDED AS AN ADDENDUM TO THE RI REPORT. A MAJOR FUNCTION OF THE INFORMATION COMMITTEE HAS BEEN TO PROVIDE OPPORTUNITIES FOR CITIZEN INPUT DURING THE TECHNICAL ACTIVITIES AT THE SITE, PARTICULARLY DURING THE DEVELOPMENT OF THE WORK PLAN, AND DURING THE REVIEW OF THE RI, EA, AND FS REPORTS.

4.0 SUMMARY OF PUBLIC COMMENTS AND AGENCY RESPONSES

THIS SECTION OF THE RESPONSIVENESS SUMMARY SUMMARIZES COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD FOR BOWERS LANDFILL AND PROVIDES US EPA'S RESPONSES TO THESE COMMENTS. THE AGENCY RECEIVED COMMENTS FROM LOCAL CITIZENS, ENVIRONMENTAL GROUPS, LOCAL OFFICIALS, AND POTENTIALLY RESPONSIBLE PARTIES. THESE COMMENTS CONCERNED THE PREFERRED REMEDIAL ALTERNATIVE (ALTERNATIVE 4), AS STATED IN THE PROPOSED PLAN, AND OTHER REMEDIAL ALTERNATIVES DEVELOPED IN THE FEASIBILITY STUDY (FS). US EPA ALSO RECEIVED COMMENTS ON WORK CONDUCTED EARLIER IN THE RI/FS PROCESS, INCLUDING THE RI AND ENDANGERMENT ASSESSMENT.

ATTACHMENT 2 TO THIS RESPONSIVENESS SUMMARY INCLUDES COPIES OF ALL WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD. ORAL COMMENTS, WHICH WERE RECORDED AT A PUBLIC MEETING ON FEBRUARY 28, 1989, ARE INCLUDED WITHIN THE TRANSCRIPT FOR THAT MEETING. THE TRANSCRIPT IS PART OF THE ADMINISTRATIVE RECORD FOR BOWERS LANDFILL. WHERE SEVERAL INDIVIDUALS OR ORGANIZATIONS SUBMITTED SIMILAR COMMENTS, A SINGLE RESPONSE IS PROVIDED. US EPA HAS GROUPED THE COMMENTS ACCORDING TO SUBJECT.

4.1 REMEDIAL ALTERNATIVE PREFERENCES

1. TWO RESIDENTS ASKED WHY A FLOOD PROTECTION DIKE WAS NOT INCLUDED AS PART OF THE PRE-REMEDIAL ALTERNATIVE.

US EPA RESPONSE: BASED ON DISCUSSIONS WITH THE US ARMY CORPS OF ENGINEERS, US EPA BELIEVES THAT THE LANDFILL CAP INSTALLED UNDER ALTERNATIVE 4 CAN BE DESIGNED AND CONSTRUCTED TO RESIST FLOOD DAMAGE OR WASHOUT OF WASTES BY A 100-YEAR FLOOD. ALTERNATIVE 4 WOULD INCLUDE FLOOD PROTECTION, IN THE FORM OF RIPRAP, ON THE ENDS OF THE LANDFILL MOST PRONE TO FLOOD DAMAGE. WHERE NECESSARY, SHEET PILING WOULD BE ADDED TO PROVIDE ADDITIONAL STABILITY. LANDFILL SIDE SLOPES WOULD BE DESIGNED TO PREVENT FAILURE DURING FLOOD CONDITIONS. A SAFE HORIZONTAL-TO -VERTICAL RATIO FOR THE SIDE SLOPES WOULD BE DETERMINED BY GEOTECHNICAL STUDIES OF THE LANDFILL SURFACE AND THE SOIL AND CLAY USED FOR THE COVER. WASTES WOULD BE COVERED BY AT LEAST 4 FEET OF NEW COVER MATERIAL AND WOULD BE REPAIRED PROMPTLY AS PART OF AN ONGOING OPERATION AND MAINTENANCE PROGRAM.

THE ADDITIONAL PROTECTION OFFERED BY THE FLOOD DIKE IS NOT PROPORTIONAL TO THE COST OF THE DIKE. ALTHOUGH THE DIKE WOULD PROVIDE ADDITIONAL LONG-TERM PROTECTION FROM FLOODS, IT WOULD PROVIDE NO ADDITIONAL REDUCTION IN INFILTRATION OF PRECIPITATION THROUGH THE LANDFILL, COMPARED TO THE CLAY CAP. THE FS ESTIMATES THE COST OF THE FLOOD PROTECTION DIKE AS APPROXIMATELY \$5.5 MILLION. THIS ADDITIONAL COMPONENT WOULD MORE THAN DOUBLE THE COST OF ALTERNATIVE 4 WHILE PROVIDING ONLY SLIGHTLY INCREASED LONG-TERM EFFECTIVENESS.

FURTHER, CONSTRUCTION OF THE DIKE WOULD REMOVE APPROXIMATELY 80 ACRES OF LAND FROM THE 100-YEAR FLOODPLAIN OF THE SCIOTO RIVER, SINCE THE DIKE WOULD PREVENT FLOODWATERS FROM COVERING THIS AREA. THIS WOULD INCREASE THE HEIGHT OF FLOODWATERS UPSTREAM AND DOWNSTREAM OF THE LANDFILL AND MAY CAUSE ADDITIONAL AREAS TO FLOOD.

2. SEVERAL RESIDENTS WANTED TO KNOW WHY HAZARDOUS WASTE LANDFILL CLOSURE REQUIREMENTS WERE NOT APPLIED TO BOWERS LANDFILL. A CITIZEN REPRESENTING ACTION, A LOCAL ENVIRONMENTAL GROUP, ASKED: "THE FEASIBILITY STUDY

STATES THAT ALTERNATIVE 4 WOULD COMPLY WITH CURRENT STATE OF OHIO CLOSURE STANDARDS FOR SOLID WASTE LANDFILLS.

SINCE HAZARDOUS WASTE WAS DUMPED AT BOWERS, I WOULD LIKE TO KNOW IF ANY OF THE ALTERNATIVES COMPLY WITH STATE OF OHIO CLOSURE STANDARDS FOR HAZARDOUS WASTE FACILITIES. IF NOT, WHY NOT"?

US EPA RESPONSE: OHIO HAZARDOUS WASTE REGULATIONS ARE MODELED AFTER US EPA HAZARDOUS WASTE REGULATIONS. THE RESOURCE CONSERVATION RECOVERY ACT (RCRA), AS AMENDED BY THE 1986 HAZARDOUS AND SOLID WASTE AMENDMENTS, REGULATES ACTIVE HAZARDOUS WASTE FACILITIES. HAZARDOUS WASTE FACILITIES THAT WERE NOT OPERATING AFTER NOVEMBER 19, 1980, ARE NOT REQUIRED TO COMPLY WITH RCRA. BECAUSE OF THIS, RCRA IS NOT APPLICABLE TO REMEDIAL ACTIONS AT BOWERS LANDFILL.

US EPA BELIEVES THAT SITE CONDITIONS, AS CURRENTLY DEFINED BY THE RI, DO NOT JUSTIFY CLOSURE OF BOWERS LANDFILL IN COMPLIANCE WITH STATE OR FEDERAL REGULATIONS FOR ACTIVE HAZARDOUS WASTE LANDFILLS. THE LANDFILL WAS USED PRIMARILY FOR DOMESTIC WASTE, NONHAZARDOUS INDUSTRIAL WASTE, AND CONSTRUCTION DEBRIS. BASED ON SITE CONDITIONS AND THE RELATIVELY LOW LEVELS OF CONTAMINANTS IN GROUND WATER, CLOSURE AS A HAZARDOUS WASTE LANDFILL IS NOT JUSTIFIED.

NEVERTHELESS, THE REMEDIAL ALTERNATIVE CHOSEN FOR BOWERS LANDFILL TAKES INTO ACCOUNT SEVERAL RCRA REQUIREMENTS FOR HAZARDOUS WASTE LANDFILLS. THE LOW-PERMEABILITY CLAY LAYER INSTALLED OVER THE LANDFILL WILL HAVE A MAXIMUM PERMEABILITY OF 10^{-7} CM/SEC. THIS COVER WOULD MEET RCRA REQUIREMENTS FOR THE CLAY LINER AT THE BOTTOM OF A HAZARDOUS WASTE LANDFILL, AS DESCRIBED IN 40 CFR 264.301. IN ADDITION, THE COVER WILL MEET RCRA GENERAL FACILITY STANDARDS IN 40 CFR 264.18. THE COVER WILL BE CONSTRUCTED, OPERATED, AND MAINTAINED TO PREVENT WASHOUT OF HAZARDOUS WASTES BY A 100-YEAR FLOOD. FINALLY, THE LONG-TERM MONITORING PROGRAM FOR BOWERS LANDFILL WILL COMPLY WITH THE SUBSTANTIVE REQUIREMENTS FOR GROUND-WATER MONITORING UNDER RCRA IN 40 CFR SUBPART F.

3. MEMBERS OF ACTION EXPRESSED CONCERN THAT "CONTAINMENT TECHNIQUES ARE UNPROVEN AND UNRELIABLE TECHNOLOGIES WITH SPECIFIC IMPLEMENTATION PROBLEMS." CONCERNS WERE RAISED THAT CONTAINMENT REMEDIES DEPEND ON EXPERT INSTALLATION, AND EVEN IF PROPERLY INSTALLED, CLAY OR SYNTHETIC MEMBRANE CAPS WILL EVENTUALLY LEAK.

US EPA RESPONSE: CAPPING, WITH EITHER CLAY OR SYNTHETIC MEMBRANE LAYERS, IS A STANDARD PROCEDURE FOR CLOSING LAND DISPOSAL UNITS THAT HAVE REACHED CAPACITY. THE CAP SERVES TWO MAIN PURPOSES PREVENTING DIRECT CONTACT AND EXPOSURE TO WASTE MATERIALS AND PREVENTING GROUND-WATER CONTAMINATION BY REDUCING INFILTRATION OF WATER THROUGH THE WASTES. THE LOW-PERMEABILITY CLAY CAP PROPOSED FOR BOWERS LANDFILL WILL SERVE BOTH PURPOSES. THE CAP WILL PREVENT DIRECT CONTACT WITH AND INGESTION OF CONTAMINATED SOILS. THE CLAY LAYER OF THE CAP WILL HAVE A PERMEABILITY OF 10^{-7} CM/SEC OR LESS AND SHOULD REDUCE INFILTRATION OF PRECIPITATION AND FLOODWATERS TO LESS THAN 10 PERCENT.

US EPA WILL TAKE SEVERAL MEASURES TO INCREASE THE EFFECTIVENESS OF THE CAP AND REDUCE THE LIKELIHOOD OF CAP FAILURE. FIRST, THE CLAY LAYER WILL BE DESIGNED AND INSTALLED UNDER A STRICT QUALITY ASSURANCE PROGRAM. THE CLAY WILL BE INSTALLED IN 6-INCH INCREMENTS (OR LIFTS). EACH LIFT WILL BE COMPACTED AND TESTED FOR PERMEABILITY BEFORE THE NEXT LIFT IS ADDED. SECOND, THE HORIZONTAL-TO-VERTICAL RATIO OF THE SIDE SLOPES WILL BE DESIGNED TO PREVENT FAILURE DURING WORST CASE FLOODING CONDITIONS. THIRD, THE CAP WILL BE INSPECTED AND MAINTAINED ACCORDING TO A REGULAR SCHEDULE, WITH ADDITIONAL INSPECTIONS SCHEDULED AFTER FLOODS. IF THE CAP LEAKS EVEN AFTER THESE PRECAUTIONARY MEASURES ARE TAKEN, THE LONG-TERM GROUND-WATER MONITORING PROGRAM, INCLUDED AS PART OF REMEDIAL ACTION, WILL DETECT INCREASES IN GROUND-WATER CONTAMINATION BEFORE THE CONTAMINATION MOVES OFF-SITE.

4. SEVERAL RESIDENTS WERE CONCERNED THAT TREATMENT TECHNOLOGIES WERE NOT CONSIDERED FOR BOWERS LANDFILL.

US EPA RESPONSE: TREATMENT TECHNOLOGIES WERE CONSIDERED IN THE FS, BUT WERE SCREENED OUT DUE TO EFFECTIVENESS, IMPLEMENTABILITY, AND COST CONSIDERATIONS. THUS, TREATMENT TECHNOLOGIES WERE NOT INCLUDED IN ANY OF THE REMEDIAL ALTERNATIVES EVALUATED IN DETAIL. THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) OF 1986 EXPRESSES A PREFERENCE FOR REMEDIAL ALTERNATIVES THAT INCLUDE TREATMENT AS A PRINCIPLE ELEMENT. HOWEVER, TREATMENT IS NOT ALWAYS PRACTICAL, ESPECIALLY AT SITES THAT HAVE LARGE VOLUMES OF LOW-CONCENTRATION WASTE MATERIALS.

THREE SPECIFIC FACTORS MAKE TREATMENT IMPRACTICAL AT BOWERS LANDFILL. FIRST, MUCH OF THE ESTIMATED 130,000 CUBIC YARDS OF WASTE MATERIAL IN THE LANDFILL CONSISTS OF GENERAL REFUSE AND MUNICIPAL SOLID WASTE, RATHER THAN HAZARDOUS WASTE. SECOND, NO OPERATING RECORDS EXIST, SO IT IS NOT POSSIBLE TO IDENTIFY SPECIFIC LOCATIONS ALONG THE 4000-FOOT LENGTH WHERE HAZARDOUS WASTES MAY HAVE BEEN DEPOSITED. THIRD, THE RELATIVELY LOW LEVELS OF CONTAMINATION FOUND DURING THE RI WOULD NOT BE EFFECTIVELY REDUCED BY TREATMENT.

5. THE POTENTIALLY RESPONSIBLE PARTIES COMMENTED THAT ALTERNATIVE 3 (LIMITED REPAIRS TO LANDFILL COVER) WAS ADEQUATELY PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT, AND THAT THE SELECTION OF ALTERNATIVE 4 (CLAY COVER OVER THE LANDFILL) WAS NOT WARRANTED.

US EPA RESPONSE: US EPA'S RATIONALE FOR SELECTING ALTERNATIVE 4 OVER ALTERNATIVE 3 IS CLEARLY STATED IN THE ROD DECISION SUMMARY. BRIEFLY, ALTERNATIVE 3 DOES NOT MEET THE TWO THRESHOLD CRITERIA FOR SELECTION AS A REMEDIAL ALTERNATIVE. ALTERNATIVE 3 DOES NOT PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT AND DOES NOT COMPLY WITH ARARS.

6. ONE RESIDENT STATED THAT COST SHOULD NOT BE A FACTOR IN CHOOSING A REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL. HE FELT THAT THE MOST EXPENSIVE TECHNOLOGIES SHOULD BE CHOSEN BECAUSE THEY ARE THE MOST PROTECTIVE. HE STATED THAT "EPA'S RIGHTFUL JOB AT THIS POINT IS TO CLEANUP THE BOWERS SITE TO THE BEST OF ITS ABILITY, NOTWITHSTANDING COST." THIS RESIDENT BELIEVED THAT THE REMEDIAL ALTERNATIVE SHOULD INCLUDE A SYNTHETIC MEMBRANE TO COVER THE LANDFILL, CONSTRUCTION OF THE MOST SOPHISTICATED DRAINAGE SYSTEM POSSIBLE, AND CONSTRUCTION OF A FLOOD CONTROL DIKE.

US EPA RESPONSE: SARA SPECIFICALLY REQUIRES US EPA TO SELECT REMEDIAL ACTIONS THAT ARE COST-EFFECTIVE. COST-EFFECTIVENESS CANNOT BE USED TO JUSTIFY THE SELECTION OF A NONPROTECTIVE REMEDY. HOWEVER, US EPA IS REQUIRED BY LAW TO CLOSELY EVALUATE THE COSTS REQUIRED TO IMPLEMENT AND MAINTAIN A REMEDY AND TO SELECT A PROTECTIVE REMEDY WHOSE COSTS ARE PROPORTIONATE TO ITS OVERALL EFFECTIVENESS.

THE NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN (NCP) PROVIDES THE REGULATORY FRAMEWORK FOR SUPERFUND. UNDER THE CURRENTLY PROPOSED REVISIONS TO THE NCP, COST IS ONE OF FIVE PRIMARY BALANCING CRITERIA FOR EVALUATING REMEDIAL ALTERNATIVES. OTHER BALANCING CRITERIA INCLUDE LONG-TERM EFFECTIVENESS; REDUCTION OF TOXICITY, MOBILITY, OR VOLUME; SHORT-TERM EFFECTIVENESS; AND IMPLEMENTABILITY. TO SELECT A REMEDIAL ALTERNATIVE, US EPA MUST FIRST DETERMINE THAT THE ALTERNATIVE MEETS THE TWO THRESHOLD CRITERIA - THE ALTERNATIVE MUST ADEQUATELY PROTECT HUMAN HEALTH AND THE ENVIRONMENT AND THE ALTERNATIVE MUST COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS). US EPA MUST THEN CONSIDER THE BALANCING CRITERIA AND CHOOSE THE REMEDIAL ALTERNATIVE THAT REPRESENTS THE BEST COMBINATION OF THESE CRITERIA. THUS, US EPA MUST CONSIDER COST IN THIS ANALYSIS.

7. ONE MEMBER OF ACTION STATED THAT A FENCE AROUND BOWER LANDFILL, A COMPONENT OF US EPA'S PREFERRED ALTERNATIVE, SHOULD BE ERECTED AS SOON AS POSSIBLE. THIS MEASURE WOULD LIMIT EXPOSURE PRIMARILY TO THOSE WHO CHOOSE TO BECOME EXPOSED.

US EPA RESPONSE: US EPA AGREES THAT INSTALLING A FENCE AROUND BOWERS LANDFILL WILL LIMIT EXPOSURE TO THOSE WHO CHOOSE TO BECOME EXPOSED. FENCING WAS INCLUDED IN ALL REMEDIAL ALTERNATIVES (EXCEPT NO ACTION) EVALUATED DURING THE FS. FENCING WILL BE IMPLEMENTED ON A PRIORITY BASIS ONCE REMEDIAL ACTION BEGINS.

4.2 TECHNICAL CONCERNS REGARDING REMEDIAL ALTERNATIVES

1. ONE MEMBER OF ACTION, A LOCAL ENVIRONMENTAL GROUP, ASKED ABOUT MAINTENANCE PROCEDURES FOR THE PREFERRED ALTERNATIVE. HE STATES THAT THE FEASIBILITY STUDY REPORT DID NOT ADEQUATELY DESCRIBE MAINTENANCE PROCEDURES.

US EPA RESPONSE: THE FEBRUARY 3, 1989, DRAFT OF THE FEASIBILITY STUDY REPORT, PAGE 4-25, STATES:

MAINTENANCE OF THE COVER WOULD INVOLVE MOWING THE VEGETATION, INSPECTING THE SURFACE FOR CRACKS, SETTLEMENT, AND PONDING OF WATER, AND MAKING APPROPRIATE REPAIRS. MAINTENANCE REQUIREMENTS FOR THE COVER CAN BE EXPECTED TO BE GREATER THAN THE PRESENT COVER AFTER FLOOD EVENTS DUE TO THE LIMITED SUBSURFACE STABILIZING CAPABILITY OF THE GRASS. DAMAGE TO THE CAP COULD OCCUR FROM EROSION, FROM PLANT ROOTS BREAKING THROUGH THE SURFACE,

FROM SUBSIDENCE DUE TO DECAYING ROOTS, FROM PENETRATION BY BURROWING ANIMALS, OR FROM VANDALISM. DIRECT EXPOSURE TO WASTES AS A RESULT OF DAMAGE IS UNLIKELY BECAUSE WASTE MATERIALS WOULD BE ISOLATED AT LEAST 4 FEET BELOW THE SURFACE. IF REPAIRS TO THE CLAY OR RESEEDING WERE REQUIRED, THIS WOULD BE CARRIED OUT IMMEDIATELY. REPAIRS TO THE CLAY WOULD CONSIST OF PATCHING WITH FRESH CLAY.

THE MINIMUM EFFECTIVE DESIGN LIFE OF CAPS IS GENERALLY 20 YEARS (K. WAGNER ET AL, REMEDIAL ACTION TECHNOLOGY FOR WASTE DISPOSAL SITES, NOYES DATA CORPORATION, PARK RIDGE, N.J., 1986, PP 19 ET SEQ.). PROPER MAINTENANCE CAN MAINTAIN THE FORMER EFFECTIVENESS. IF WELL MAINTAINED, THERE WOULD BE VIRTUALLY NO LONG-TERM THREAT TO PUBLIC HEALTH OR THE ENVIRONMENT.

THE MAINTENANCE PROGRAM WOULD ALSO INCLUDE INSPECTION OF THE COVER FOR STRUCTURAL INTEGRITY ON A REGULARLY SCHEDULED BASIS. FOLLOWING PERIODS OF FLOODING, THE LANDFILL COVER WOULD BE INSPECTED FOR SIGNS OF EROSION AND REPAIRED AS NECESSARY. THIS PROGRAM WOULD INCLUDE REPAIR OF RIPRAP PROTECTION, AS NECESSARY, AND INSPECTION FOR DAMAGE FROM SCOURING, WAVE ACTIONS AND DEBRIS, TOGETHER WITH REPAIR AS NECESSARY.

US EPA BELIEVES THAT THE INTENT OF THE MAINTENANCE IS CLEARLY STATED IN THE ABOVE TEXT. THE PURPOSE OF A FEASIBILITY STUDY (FS) IS TO PROVIDE A GENERAL DESCRIPTION OF REMEDIAL ACTION TECHNOLOGIES AND TO SUMMARIZE THE IMPLEMENTATION METHODS. SPECIFIC OPERATIONAL GUIDELINES THAT WOULD INCLUDE INSPECTION LOGS, INSPECTION SCHEDULES, INSPECTION METHODS, AND DESCRIPTIONS OF CORRECTIVE ACTIONS WILL BE DETAILED IN THE REMEDIAL DESIGN (RD). THE RD IS INTENDED TO BE A BLUEPRINT FOR IMPLEMENTATION WHILE THE FS IS A BROADER CONCEPTUAL STUDY OF REMEDIAL OPTIONS FOR THE SITE.

2. SEVERAL RESIDENTS, ACTION, THE CIRCLEVILLE CITY COUNCIL, AND THE CITY OF CIRCLEVILLE WATER DEPARTMENT EXPRESSED CONCERNS ABOUT LONG-TERM GROUND-WATER MONITORING AT THE SITE. THESE CONCERNS ARE RELATED TO PROTECTION OF THE CITY'S WATER SUPPLY, WHICH IS OBTAINED FROM A WELLFIELD APPROXIMATELY 1 1/2 MILES SOUTH OF THE LANDFILL. SPECIFICALLY, COMMENTERS REQUESTED THE NEW MONITORING WELLS BE INSTALLED BETWEEN THE LANDFILL AND THE CITY'S WELLS. COMMENTERS ALSO WANTED TO KNOW HOW THE PROPOSED MONITORING PROGRAM WOULD DETECT AND PREVENT OFF-SITE MIGRATION OF GROUND-WATER CONTAMINATION. FINALLY, SOME COMMENTERS FELT THAT TESTING OF PRIVATE WELLS SOUTH OF THE LANDFILL AND TESTING OF THE CITY'S WELLS SHOULD ALSO BE INCLUDED IN THE MONITORING PROGRAM.

US EPA RESPONSE: LONG-TERM GROUND-WATER MONITORING WILL BE CONDUCTED AT BOWERS LANDFILL AS PART OF THE REMEDIAL ALTERNATIVE. AS NOTED ABOVE, THE MONITORING PROGRAM WILL BE BASED OF RCRA GROUND-WATER MONITORING REQUIREMENTS FOR ACTIVE HAZARDOUS WASTE FACILITIES. THE MONITORING PROGRAM WILL INCLUDE INSTALLING ADDITIONAL MONITORING WELLS SOUTH OF BOWERS LANDFILL (BETWEEN THE LANDFILL AND THE CIRCLEVILLE MUNICIPAL WELLFIELD) AND WEST OF THE LANDFILL (BETWEEN THE LANDFILL AND THE SCIOTO RIVER). THE PROGRAM MAY ALSO INCLUDE SAMPLING OF PRIVATE RESIDENTIAL WELLS SOUTH OF THE SITE.

TESTING OF THE CITY'S WELLS IS REQUIRED BY FEDERAL LAW. TESTING WAS CONDUCTED QUARTERLY DURING 1988 FOR A LARGE LIST OF VOLATILE ORGANIC COMPOUNDS (VOCs), INCLUDING EIGHT VOCs FOR WHICH THERE ARE FEDERAL DRINKING WATER STANDARDS. NONE OF THESE VOCs WERE DETECTED IN SAMPLES FROM THE CIRCLEVILLE WELLS. IN ADDITION, NONE OF THE VOCs FOUND IN GROUND-WATER SAMPLES FROM BOWERS LANDFILL WERE FOUND IN THE CIRCLEVILLE WATER SUPPLY. AFTER REVIEWING THE QUARTERLY SAMPLING RESULTS FOR 1988, OEPA INFORMED THE CITY THAT "NO REPEAT MONITORING SCHEDULE HAS BEEN ESTABLISHED BY THE OHIO ENVIRONMENTAL PROTECTION AGENCY (OHIO EPA) BUT, IT IS ANTICIPATED THAT THE SUBMITTAL OF QUARTERLY VOC SAMPLES WILL BE REQUIRED AGAIN IN 1991".

US EPA BELIEVES THAT THE COMBINATION OF THESE TWO PROGRAMS (LONG-TERM GROUND-WATER MONITORING AT BOWERS LANDFILL PLUS TESTING OF THE CIRCLEVILLE WATER SUPPLY BY THE CITY OF CIRCLEVILLE) WILL RESULT IN MONITORING THAT IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND SUFFICIENT TO IDENTIFY ANY FUTURE RELEASES TO GROUND WATER FROM THE LANDFILL.

3. SEVERAL RESIDENTS REQUESTED THAT US EPA PROVIDE ADDITIONAL DETAILS ABOUT THE PROPOSED GROUND-WATER MONITORING PROGRAM (FOR EXAMPLE, NUMBER AND LOCATIONS OF WELLS SAMPLED, FREQUENCY OF SAMPLING, AND CHEMICALS MEASURED).

US EPA RESPONSE: AS NOTED ABOVE, GROUND-WATER MONITORING WILL REQUIRE REGULAR AND SYSTEMATIC SAMPLING. THE MONITORING PROGRAM WILL MEET THE SUBSTANTIVE REQUIREMENTS FOR GROUND-WATER MONITORING UNDER THE RESOURCE

CONSERVATION AND RECOVERY ACT (RCRA) AS DESCRIBED IN 40 CFR SUBPART F.

THE INSTALLATION OF THREE ADDITIONAL GROUND-WATER MONITORING WELL CLUSTERS IS NECESSARY TO DEVELOP A GROUND-WATER MONITORING PROGRAM THAT WILL ADEQUATELY DETECT POTENTIAL FUTURE RELEASES OF CONTAMINANTS. THESE CLUSTERS WILL CONSIST OF THREE WELLS - A SHALLOW WELL LOCATED IN THE UPPER PORTION OF THE UPPER AQUIFER, AN INTERMEDIATE WELL LOCATED BETWEEN THE WATER TABLE AND THE BEDROCK, AND A DEEP WELL LOCATED JUST ABOVE THE BEDROCK. TWO WELL CLUSTERS WILL BE INSTALLED WEST OF THE LANDFILL, ONE CLUSTER BETWEEN WELL LOCATION 5 AND WELL LOCATION 6 AND THE OTHER BETWEEN WELL W-10 AND THE BEND OF THE LANDFILL. THE THIRD WELL CLUSTER WILL BE INSTALLED OFF-SITE BETWEEN THE LANDFILL AND THE CIRCLEVILLE MUNICIPAL WELLFIELD. THE INSTALLATION OF ADDITIONAL WELL CLUSTERS MAY ALSO BE CONSIDERED.

THE MONITORING WELLS WILL BE SAMPLED BIMONTHLY FOR THE FIRST YEAR AND QUARTERLY FOR YEARS 2 THROUGH 4. DURING THE FIRST YEAR, SAMPLES WILL BE ANALYZED FOR THE FULL TARGET COMPOUND LIST (TCL). A REDUCED TCL MAY BE CONSIDERED AFTER THE FIRST YEAR. IF GROUND-WATER CONTAMINANT LEVELS DO NOT INCREASE OVER THIS 4-YEAR PERIOD, THE SAMPLING SCHEDULE WILL BE REEVALUATED AND THE FREQUENCY OF SAMPLING MAY BE REDUCED.

4. SEVERAL RESIDENTS REQUESTED ADDITIONAL INFORMATION ON THE STEPS US EPA WOULD TAKE IF LONG-TERM MONITORING RESULTS SHOWED INCREASES IN GROUND-WATER CONTAMINANT LEVELS.

US EPA RESPONSE: THE MONITORING PROPOSED AS PART OF THE REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL WILL BE DESIGNED TO DETECT INCREASES IN GROUND-WATER CONTAMINANT CONCENTRATIONS DUE TO THE LANDFILL. A STATISTICAL TEST WILL BE DEVELOPED TO DETERMINE WHEN A SIGNIFICANT INCREASE IN GROUND-WATER CONTAMINATION HAS OCCURRED.

SHOULD A SIGNIFICANT INCREASE IN THE LEVELS OF CONTAMINANTS OCCUR, THE INCREASE WILL AUTOMATICALLY TRIGGER A RCRA CORRECTIVE ACTION. IF THE LEVELS OF CONTAMINANTS IN GROUND WATER EXCEED MCLS, WHERE AVAILABLE, OR HEALTH-BASED LEVELS, WHERE MCLS ARE NOT AVAILABLE, RESAMPLING WILL OCCUR WITHIN 14 DAYS. (HEALTH-BASED LEVELS ARE CONCENTRATIONS CORRESPONDING TO A CANCER RISK OF 10⁻⁶ FOR CARCINOGENIC CONTAMINANTS AND A HAZARD INDEX (HI) GREATER THAN 1 FOR NONCARCINOGENIC CONTAMINANTS.) IF THE RESAMPLING VERIFIES THAT THERE HAS BEEN A SIGNIFICANT INCREASE IN CONTAMINANT LEVELS, A CORRECTIVE ACTION PROGRAM WILL BE IMPLEMENTED. CORRECTIVE ACTION MAY INCLUDE SUCH MEASURES AS ESTABLISHING ALTERNATE CONCENTRATION LIMITS (ACLs), COLLECTING AND TREATING GROUND WATER, OR REMOVING THE SOURCE OF CONTAMINATION.

US EPA WILL MAKE EVERY EFFORT TO MINIMIZE DELAYS, SHOULD CORRECTIVE ACTION BE NEEDED IN THE FUTURE AT BOWERS LANDFILL. DETAILS ON THE SCHEDULING, TIMING, AND NATURE OF POSSIBLE CORRECTIVE ACTIONS WILL BE ADDRESSED DURING REMEDIAL DESIGN.

5. ONE RESIDENT WANTED TO KNOW THE ESTIMATED COSTS FOR EXCAVATING THE LANDFILL.

US EPA RESPONSE: EXCAVATION COSTS AT HAZARDOUS WASTE SITES VARY ACCORDING TO THE TYPE OF EXCAVATION EQUIPMENT USED, LEVELS OF WORKER PROTECTION REQUIRED, AND OTHER SITE-SPECIFIC FACTORS. HOWEVER, A TYPICAL COST ESTIMATE FOR EXCAVATION IN LEVEL B PROTECTION IS APPROXIMATELY \$60 PER CUBIC YARD. USING THIS FIGURE, THE TOTAL COST TO EXCAVATE ALL OF THE ESTIMATED 130,000 CUBIC YARDS OF WASTE IN BOWERS LANDFILL WOULD BE APPROXIMATELY \$8 MILLION. THIS ESTIMATE DOES NOT INCLUDE ADDITIONAL COSTS FOR REMOVING EXCAVATED WASTES FROM THE SITE, PACKING THE WASTES FOR REMOVAL, OR TREATING THE WASTES.

6. SEVERAL RESIDENTS EXPRESSED CONCERNS THAT WHILE A CLAY CAP WOULD REDUCE INFILTRATION THROUGH THE TOP OF THE LANDFILL, LEAKAGE WAS MORE LIKELY TO OCCUR THROUGH THE BOTTOM. BECAUSE NO BORINGS WERE DRILLED THROUGH THE LANDFILL, US EPA CANNOT BE SURE THAT THERE IS AN ADEQUATE CONFINING LAYER BELOW THE WASTES.

US EPA RESPONSE: AN 8 TO 15-FOOT THICK LAYER OF SILT OR CLAY WAS OBSERVED AT ALL BORINGS COMPLETED ADJACENT TO THE LANDFILL. THESE BORINGS INDICATED THAT A NATURAL LAYER OF LOW-PERMEABILITY MATERIAL WAS PRESENT AT THE TIME OF LANDFILL CONSTRUCTION. INFORMATION AVAILABLE TO US EPA INDICATES THAT MOST WASTE MATERIALS WERE DEPOSITED DIRECTLY ON THIS LAYER, ALTHOUGH SOME PORTIONS OF THIS LAYER MAY HAVE BEEN EXCAVATED DURING LANDFILLING ACTIVITIES.

BECAUSE BOWERS LANDFILL DOES NOT HAVE AN ENGINEERED LINER BELOW THE WASTES, THERE IS A POTENTIAL FOR LEACHING FROM THE BOTTOM OF THE LANDFILL. HOWEVER, THE MAJOR DRIVING FORCE IN PRODUCING LEACHATE IS INFILTRATION

OF WATER. THE LOW-PERMEABILITY CLAY CAP (10⁻⁷ CM/SEC OF LESS) WILL GREATLY REDUCE THE INFILTRATION OF BOTH PRECIPITATION AND FLOODWATERS THAT MIGHT CREATE LEACHATE. ANOTHER FACTOR THAT US EPA CONSIDERED WAS THAT LEACHATE, WHEN GENERATED, WOULD FIRST ENTER THE UPPER PORTION OF THE AQUIFER DOWNGRADIENT OF THE LANDFILL. GROUND-WATER TESTING DURING THE RI SHOWED THAT CONTAMINANT LEVELS IN THIS AQUIFER WERE VERY LOW AND DID NOT IDENTIFY A LEACHATE PLUME.

FOR THESE REASONS, US EPA BELIEVES THAT CAPPING SHOULD BE THE FIRST STEP IN LESSENING THE POTENTIAL FOR LEACHATE PRODUCTION. CAPPING WILL BE COUPLED WITH FREQUENT MONITORING FOR HAZARDOUS CONSTITUENTS IN SITE GROUND WATER. SHOULD FURTHER GROUND-WATER TESTING IDENTIFY LEACHATE AS A PROBLEM, THEN SOURCE REDUCTION TECHNIQUES, SUCH AS LEACHATE COLLECTION AND TREATMENT, WILL BE IMPLEMENTED AS PART OF A CORRECTIVE ACTION PROGRAM.

7. ONE MEMBER OF ACTION FELT THAT US EPA'S PREFERRED REMEDIAL ALTERNATIVE WAS "THE EQUIVALENT OF DOING NOTHING WHILE WAITING FOR RAINFALL AND FLOODS TO FLUSH THE CONTAMINANTS INTO THE SURFACE AND GROUNDWATER."

US EPA RESPONSE: AS DISCUSSED IN THE PREVIOUS RESPONSE, US EPA BELIEVES THAT THE REMEDIAL ALTERNATIVE SELECTED FOR BOWERS LANDFILL REPRESENTS AN ACTIVE MEASURE TO CONTAIN CONTAMINANTS WITHIN THE LANDFILL, RATHER THAN ALLOWING THESE CONTAMINANTS TO BE FLUSHED OUT BY RAINFALL AND FLOODS.

8. ONE RESIDENT ASKED UNDER "WHAT CIRCUMSTANCES HAVE GAS VENTING AND LEACHATE COLLECTION SYSTEMS BEEN RECOMMENDED AND HOW DO THESE CIRCUMSTANCES DIFFER FROM THE BOWERS SITE?"

US EPA RESPONSE: GAS CAN BE GENERATED WITHIN A LANDFILL BY MICROBIAL DEGRADATION OF ORGANIC MATERIALS OR BY VOLATILIZATION OF ORGANIC LIQUIDS. THE PERIOD OF ACTIVE GAS GENERATION WITHIN A LANDFILL CAN VARY WIDELY DEPENDING ON SITE-SPECIFIC CONDITIONS SUCH AS TEMPERATURE, PH, MOISTURE CONTENT OF THE REFUSE, OXYGEN CONTENT, AND REFUSE COMPOSITION.

IS THE ABSENCE OF A LOW-PERMEABILITY LAYER ABOVE THE WASTE MATERIALS, MOST LANDFILL GASES WILL ESCAPE THROUGH THE TOP OF THE LANDFILL. THIS IS MOST LIKELY THE CASE WITH BOWERS LANDFILL. WASTES HAVE BEEN IN PLACE FROM 20 TO 30 YEARS AND ARE COVERED WITH A THIN LAYER OF HIGHLY PERMEABLE SOIL. FURTHER, BECAUSE WASTES WERE PILED ON THE GROUND, RATHER THAN PLACED IN THE GROUND, THE LANDFILL HAS A LARGE SURFACE AREA (RELATIVE TO THE WASTE VOLUME) FOR GASES TO ESCAPE. THESE OBSERVATIONS, PLUS THE LOW ORGANIC VAPOR CONCENTRATIONS MEASURED DURING THE RI, SUGGEST THAT BOWERS LANDFILL IS NOT ACTIVELY GENERATING SIGNIFICANT QUANTITIES OF GAS.

GAS COLLECTION AND VENTING SYSTEMS ARE NORMALLY INSTALLED WHEN LANDFILLS ACTIVELY GENERATING GAS ARE CAPPED WITH LOW-PERMEABILITY MATERIALS. CAPPING PREVENTS GASES FROM ESCAPING THROUGH THE TOP OF THE LANDFILL AND FORCES THE GASES TO MOVE MORE SLOWLY IN A LATERAL DIRECTION. TYPICALLY, COLLECTION SYSTEMS ARE INSTALLED AT THE PERIMETER OF THE LANDFILL TO PREVENT GASES FROM MIGRATING OFF-SITE. HOWEVER, COLLECTION SYSTEMS CAN ALSO BE INSTALLED IN THE INTERIOR OF THE LANDFILL. BECAUSE BOWERS LANDFILL DOES NOT APPEAR TO BE ACTIVELY GENERATING GAS, A GAS COLLECTION SYSTEM WAS NOT INCLUDED AS PART OF THE SELECTED REMEDIAL ALTERNATIVE.

LEACHATE COLLECTION SYSTEMS ARE REQUIRED FOR NEW HAZARDOUS WASTE LANDFILLS AS PART OF THE BOTTOM LINER. THESE SYSTEMS COLLECT AND DRAIN LEACHATE, PREVENTING THE LEACHATE FROM REACHING THE BOTTOM LINER, PENETRATING THE LINER, AND CONTAMINATING GROUND WATER BELOW THE LANDFILL. SUCH A SYSTEM CANNOT BE CONSTRUCTED UNDER THE WASTES ALREADY IN BOWERS LANDFILL.

THE LEACHATE COLLECTION SYSTEM PROPOSED FOR BOWERS LANDFILL IN THE FS REPORT DIFFERS FROM THIS DESIGN AND WOULD BE MUCH LESS EFFECTIVE.

THE LEACHATE COLLECTION SYSTEM WOULD CONSIST OF A 1-FOOT DRAINAGE LAYER OF HIGH-PERMEABILITY SAND AND GRAVEL. THIS LAYER WOULD BE PLACED ON THE LANDFILL SURFACE, BEFORE THE CLAY CAP IS APPLIED. AT THE EDGES OF THE LANDFILL, WHERE THIS DRAINAGE LAYER MEETS THE EXISTING LAND SURFACE, A 2-FOOT DEEP TRENCH WOULD BE DUG. THE DRAINAGE LAYER WOULD EXTEND INTO THIS TRENCH.

THIS TYPE OF A LEACHATE COLLECTION SYSTEM WOULD COLLECT MOST OF THE PRECIPITATION AND FLOODWATER THAT PASSED THROUGH THE LANDFILL CAP. HOWEVER, ONLY A SMALL FRACTION OF THIS WATER WOULD INFILTRATE THE LOW-PERMEABILITY CAP. THE COLLECTION SYSTEM WOULD NOT EXTEND DOWN TO THE WATER TABLE AND WOULD NOT COLLECT

GROUND WATER MOVING AWAY FROM THE LANDFILL. THUS, US EPA HAS DETERMINED THAT THE ADDITION OF A LEACHATE COLLECTION SYSTEM WOULD ONLY marginally INCREASE THE EFFECTIVENESS OF THE LANDFILL CAP.

9. ONE RESIDENT COMMENTED THAT US EPA'S PROPOSED PLAN "FAILS TO ADDRESS THE FACT THAT A LARGE DIAMETER NATURAL GAS TRANSMISSION LINE CROSSES THE NORTHEAST CORNER OF THE SITE."

US EPA RESPONSE: US EPA IS AWARE OF THIS GAS TRANSMISSION LINE. HOWEVER, THE AGENCY DOES NOT BELIEVE THAT THE PRESENCE OF THIS LINE WILL INTERFERE WITH REMEDIAL CONSTRUCTION ACTIVITIES. US EPA WILL REVIEW THIS ISSUE FURTHER DURING REMEDIAL DESIGN. PRIOR TO CONSTRUCTION, US EPA WILL CONDUCT A FIELD SURVEY TO CONFIRM THE ACTUAL LOCATION OF THE GAS TRANSMISSION LINE, AS WELL AS OTHER UNDERGROUND UTILITIES THAT MIGHT BE PRESENT.

10. THE CITY OF CIRCLEVILLE COMMENTED THAT "BOTH THE SHEETPIILING PROTECTION AND THE AMOUNT OF RIPRAP TO BE INSTALLED IS NOT SUFFICIENT GIVEN THE FACT THAT DURING SEVERE FLOODS THE ENTIRE NORTH LEG OF THE LANDFILL IS AT RISK." THE CITY ALSO COMMENTED THAT "SHEETPIILING NEEDS TO BE INSTALLED" AT THE SOUTH END OF THE LANDFILL "TO PREVENT UNDERMINING OF THE RIPRAP IN THIS AREA AND THE RIPRAP ITSELF NEEDS TO BE EXTENDED CONSIDERABLY."

US EPA RESPONSE: US EPA WILL CONSIDER THE NEED TO EXTEND EROSION PROTECTION IN GREATER DETAIL DURING REMEDIAL DESIGN. APPENDIX D OF THE FS REPORT CONTAINS A PRELIMINARY EROSION PROTECTION ANALYSIS. THIS ANALYSIS IDENTIFIES SEVERAL AREAS (INCLUDING THOSE IDENTIFIED BY THE CITY OF CIRCLEVILLE) THAT MAY REQUIRE EROSION PROTECTION BEYOND THAT INCLUDED IN THE CONCEPTUAL DESIGN OF THE REMEDIAL ALTERNATIVE. A MORE DETAILED EROSION PROTECTION ANALYSIS WILL BE CONDUCTED PRIOR TO DESIGNING AND CONSTRUCTING THE EROSIONS PROTECTION SYSTEM FOR THE LANDFILL CAP.

4.3 PUBLIC PARTICIPATION PROCESS

1. SEVERAL RESIDENTS REQUESTED THAT THE BOWERS LANDFILL INFORMATION COMMITTEE, WHICH MET REGULARLY DURING THE RI/FS PROCESS, BE CONTINUED DURING DESIGN AND IMPLEMENTATION OF THE REMEDIAL ALTERNATIVE SELECTED FOR BOWERS LANDFILL.

US EPA RESPONSE: US EPA PLANS TO CONTINUE THE BOWERS LANDFILL INFORMATION COMMITTEE DURING REMEDIAL DESIGN AND REMEDIAL ACTION (RD/RA). HOWEVER, THE MAKEUP OF THE COMMITTEE WILL VARY DEPENDING ON HOW DESIGN AND CONSTRUCTION IS CONDUCTED. THREE POSSIBLE OPTIONS ARE:

- * FEDERAL-LEAD, WITH THE RD/RA CONDUCTED BY THE US ARMY CORPS OF ENGINEERS OR BY A US EPA CONTRACTOR
- * PRP-LEAD, WITH THE RD/RA CONDUCTED BY THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) UNDER A CONSENT DECREE
- * PRP-LEAD, WITH THE RD/RA CONDUCTED BY THE PRPS UNDER A UNILATERAL ORDER

UNDER THE SECOND AND THIRD OPTIONS, US EPA WOULD OVERSEE THE RD/RA. THE FORMAT OF THE INFORMATION COMMITTEE WILL BE DETERMINED BY THE OPTION THAT IS CHOSEN. US EPA EXPECTS THIS TO OCCUR DURING THE SUMMER OR FALL OF 1989.

2. ONE RESIDENT EXPRESSED CONCERN THAT THE PUBLIC COMMENT PERIOD OF 30 DAYS WAS NOT ADEQUATE AND THAT ADDITIONAL TIME WAS NEEDED FOR THE PUBLIC TO REVIEW AND COMMENT ON US EPA'S PROPOSED PLAN.

US EPA RESPONSE: US EPA BELIEVES THAT A 30-DAY PUBLIC COMMENT PERIOD ON THE PROPOSED PLAN IS SUFFICIENT FOR BOWERS LANDFILL DUE TO THE LONG-TERM INVOLVEMENT OF CITIZENS AND CITIZENS' GROUPS IN THE RI/FS PROCESS. THE PUBLIC COMMENT PERIOD BEGAN ON FEBRUARY 14, 1989, SHORTLY AFTER THE RELEASE OF THE PROPOSED PLAN, AND EXTENDED TO MARCH 16, 1989. MOST OF THE COMMENTS RECEIVED BY US EPA HAVE COME FROM INDIVIDUALS AND ORGANIZATIONS THAT HAVE ATTENDED THE INFORMATION COMMITTEE MEETINGS, COMMENTED THROUGHOUT THE RI/FS, AND BEEN KEPT ABREAST OF TECHNICAL ISSUES CONCERNING BOWERS LANDFILL.

US EPA OFFERS THE FOLLOWING INFORMATION TO SUPPORT THE ADEQUACY OF A 30-DAY COMMENT PERIOD. THE AGENCY CONDUCTED AN EXTENSIVE COMMUNITY RELATIONS PROGRAM IN CONJUNCTION WITH THE RI/FS. THIS PROGRAM INCLUDED 12 MEETINGS OF THE BOWERS LANDFILL INFORMATION COMMITTEE, WHERE US EPA, OEPA, TECHNICAL REPRESENTATIVES OF THE PRPS, LOCAL GOVERNMENT OFFICIALS, AND CITIZENS' GROUPS MET TO KEEP THE PUBLIC INFORMED OF PROGRESS DURING THE RI/FS. DURING ALL OF THESE MEETINGS, INDIVIDUALS FROM THE COMMUNITY WERE ALLOWED TO ASK QUESTIONS THROUGH REPRESENTATIVES ON THE BOWERS LANDFILL INFORMATION COMMITTEE. US EPA HAS RESPONDED TO THESE QUESTIONS AND CONCERNS ON AN ONGOING BASIS. A DRAFT OF THE FS, ON WHICH US EPA BASED ITS SELECTION OF A REMEDIAL ALTERNATIVE, WAS RELEASED TO THE INFORMATION COMMITTEE IN SEPTEMBER 1988. RESULTS OF THE FS WERE DISCUSSED AT A COMMITTEE MEETING IN NOVEMBER 1988, SEVERAL MONTHS BEFORE THE PROPOSED PLAN WAS RELEASED.

3. ONE RESIDENT EXPRESSED CONCERN THAT THE PUBLIC COMMENT PERIOD DID NOT OFFER THE CIRCLEVILLE COMMUNITY "A GENUINE OPPORTUNITY TO CHANGE THE EPA'S POSITION."

US EPA RESPONSE: AS NOTED ABOVE, THE PUBLIC HAS BEEN ACTIVELY INVOLVED IN ALL ASPECTS OF THE RI/FS PROCESS. US EPA HAS RECEIVED A NUMBER OF COMMENTS AND HAS SERIOUSLY CONSIDERED THESE COMMENTS. SEVERAL COMMENTS HAVE RESULTED IN MINOR CHANGES TO THE PREFERRED REMEDIAL ALTERNATIVE. THESE CHANGES INCLUDE:

- * EXPANDING PROPOSED GROUND-WATER MONITORING AT BOWERS LANDFILL TO MEET THE SUBSTANTIVE REQUIREMENTS OF RCRA.
- * INSTALLING ADDITIONAL MONITORING WELLS SOUTH AND WEST OF BOWERS LANDFILL AND POSSIBLE INCLUSION OF RESIDENTIAL WELLS AS PART OF THE LONG-TERM MONITORING PROGRAM.
- * INCLUDING SURFACE WATER MONITORING AS PART OF THE LONG-TERM MONITORING PROGRAM TO VERIFY THAT THE LANDFILL IS NOT AFFECTING THE SCIOTO RIVER VIA SURFACE WATER DISCHARGES.
- * LOWERING THE PERMEABILITY OF THE CLAY LAYER OF THE LANDFILL COVER TO 10⁻⁷ CM/SEC. THIS REVISED PERMEABILITY IS BASED ON REQUIREMENTS FOR CLAY LAYERS INSTALLED AS COMPONENTS OF RCRA LANDFILL LINERS.

4.4 COST AND FUNDING ISSUES

1. LOCAL RESIDENTS EXPRESSED CONCERN ABOUT THE LIABILITY OF POTENTIALLY RESPONSIBLE PARTIES (PRPS) FOR IMPLEMENTATION, MONITORING, AND MAINTENANCE OF REMEDIAL ACTIONS AT BOWERS LANDFILL. SPECIFICALLY, RESIDENTS WANTED TO KNOW HOW THIS LIABILITY WOULD BE TRANSFERRED IF PRPS WERE ACQUIRED BY OTHER COMPANIES OR FILED FOR BANKRUPTCY.

US EPA RESPONSE: SUPERFUND LIABILITIES ARE TREATED IN MUCH THE SAME WAY AS ANY OTHER CORPORATE LIABILITY. IF A COMPANY WITH LIABILITY FOR A HAZARDOUS WASTE CLEANUP IS SOLD, THE BUYER MAY OR MAY NOT AGREE TO TAKE ON THE SELLER'S LIABILITY. THE DEBT, HOWEVER, IS NOT EXTINGUISHED BY THE TRANSFER OF OTHER ASSETS. SIMILARLY, A RESTRUCTURING DOES NOT RELEASE A COMPANY FROM LIABILITY.

BANKRUPTCY MAY RELIEVE A COMPANY OR INDIVIDUAL OF CERTAIN DEBTS. DEBTS OWED TO THE FEDERAL GOVERNMENT FOR COSTS INCURRED DURING THE CLEANUP OF HAZARDOUS WASTE SITES, HOWEVER, ARE GIVEN A HIGH PRIORITY AMONG BANKRUPTCY CLAIMS. ANY FUNDS NOT RECOVERABLE FROM THE PRPS, FOR CLEANUP OR OPERATION AND MAINTENANCE, WOULD BE PROVIDED FROM SUPERFUND MONIES OR BY THE STATE OF OHIO.

2. A PICKAWAY COUNTY COMMISSIONER EXPRESSED CONCERN THAT THE COUNTY DID NOT HAVE THE FUNDING TO PAY FOR REMEDIAL ACTION AT BOWERS LANDFILL.

US EPA RESPONSE: US EPA DOES NOT CONSIDER PICKAWAY COUNTY TO BE A PRP FOR BOWERS LANDFILL AT THIS TIME. IF THE COUNTY IS NOT A PRP, IT WILL NOT BE REQUIRED TO FUND ANY PORTION OF REMEDIAL ACTION COSTS.

3. ONE MEMBER OF ACTION WANTED TO KNOW WHO WOULD BE FINANCIALLY RESPONSIBLE SHOULD THE CHOSEN REMEDIAL

ALTERNATIVE EVENTUALLY FAIL.

US EPA RESPONSE: THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FOR BOWERS LANDFILL WOULD MOST LIKELY BE FINANCIALLY RESPONSIBLE SHOULD THE CHOSEN REMEDIAL ALTERNATIVE EVENTUALLY FAIL. SECTION 122(F) OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) ALLOWS US EPA TO GRANT PRPS A RELEASE FROM FUTURE LIABILITY AT THE COMPLETION OF REMEDIAL ACTION. IN GRANTING SUCH A RELEASE, US EPA WOULD CONSIDER SUCH FACTORS AS THE EFFECTIVENESS AND RELIABILITY OF THE REMEDIAL ACTION, THE NATURE OF REMAINING RISKS, AND THE EXTENT TO WHICH THE REMEDIAL ACTION REPRESENTS A PERMANENT REMEDY FOR THE SITE. BECAUSE THE REMEDIAL ACTION FOR BOWERS LANDFILL IS NOT A PERMANENT REMEDY AND LEAVES WASTES IN PLACE, US EPA WOULD NOT LIKELY GRANT A RELEASE FOR LIABILITY.

4. ONE MEMBER OF ACTION STATED THAT COST ESTIMATES IN THE FS "DO NOT TAKE INTO ACCOUNT THE POTENTIAL FOR ASTRONOMICAL INCREASES WHEN THESE IMPERMANENT REMEDIES EVENTUALLY FAIL."

US EPA RESPONSE: THE PURPOSE OF THE RI/FS IS TO STUDY CURRENT CONDITIONS OF A HAZARDOUS WASTE SITE, TO EVALUATE THE POTENTIAL EFFECTS OF CONTAMINANT RELEASES FROM THE SITE, AND THEN TO PROPOSE REMEDIAL ALTERNATIVES FOR THE SITE THAT PROTECT HUMAN HEALTH AND THE ENVIRONMENT. WHILE CONDITIONS MAY CHANGE IN THE FUTURE, THE PURPOSE OF THE RI/FS PROCESS IS TO SELECT A REMEDIAL ALTERNATIVE THAT WILL SUCCEED IN PROVIDING LONG-TERM PROTECTION, RATHER THAN A REMEDY DESIGNED TO FAIL. THUS, THE USE OF THEORETICAL FUTURE CONDITIONS AS A BASIS FOR ESTIMATING COSTS OF REMEDIAL ALTERNATIVES IS NOT THE INTENT OF SUPERFUND.

4.5 ENFORCEMENT ISSUES

1. ONE MEMBER OF ACTION EXPRESSED CONCERN THAT THE POTENTIALLY RESPONSIBLE PARTIES WERE ALLOWED TO WRITE THE FEASIBILITY STUDY FOR BOWERS LANDFILL.

US EPA RESPONSE: SECTION 104(A) OF SARA GIVES US EPA THE AUTHORITY TO ALLOW PRPS TO CONDUCT A REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (1) IF THE PRPS DEMONSTRATE THEIR QUALIFICATIONS TO DO THE WORK AND (2) IF US EPA OVERSEES AND REVIEWS THE WORK. BY ALLOWING THE PRPS TO CONDUCT THE RI/FS AT THEIR OWN EXPENSE, US EPA IS ABLE TO SAVE SUPERFUND MONIES FOR SITES WHERE NO PRPS CAN BE IDENTIFIED.

THE BOWERS LANDFILL RI/FS WAS CONDUCTED UNDER SUCH AN ARRANGEMENT. IN 1985, US EPA AND OEPA SIGNED A CONSENT ORDER WITH E.I. DUPONT DENEMOURS & COMPANY (DUPONT) AND PPG INDUSTRIES, INC. (PPG), TWO OF THE PRPS. WHILE DUPONT AND PPG CONDUCTED THE RI/FS, ALL PHASES OF THE WORK WERE REVIEWED AND OVERSEEN BY US EPA AND OEPA.

4.6 REMEDIAL INVESTIGATION ISSUES

1. SEVERAL RESIDENTS EXPRESSED CONCERN ABOUT THE ADEQUACY OF THE SOURCE INVESTIGATION. SPECIFICALLY, THEY WANTED TO KNOW WHY THE AMOUNTS AND LOCATIONS OF HAZARDOUS WASTES IN BOWERS LANDFILL REMAIN UNKNOWN. WITHOUT THIS INFORMATION, US EPA DOES NOT HAVE THE TECHNICAL DATA TO SUPPORT ITS CHOICE OF A REMEDIAL ALTERNATIVE.

US EPA RESPONSE: US EPA BELIEVES THAT DATA IN THE RI AND EA REPORTS ADEQUATELY SUPPORT THE CHOICE OF A REMEDIAL ALTERNATIVE FOR BOWERS LANDFILL. DURING THE RI, A LARGE NUMBER OF SAMPLES WERE COLLECTED FROM SOIL, SEDIMENT, SURFACE WATER, AND GROUND WATER DIRECTLY ADJACENT TO THE LANDFILL. THE RESULTS OF ALL SAMPLES INDICATED RELATIVELY LOW LEVELS OF CONTAMINATION, AND NO CLEARLY IDENTIFIABLE "HOT SPOTS." SAMPLING RESULTS FROM THIS FIRST PHASE OF THE RI INDICATED MINIMAL MIGRATION OF CONTAMINANTS FROM THE LANDFILL. THUS, US EPA DETERMINED THAT A SECOND PHASE OF THE RI, WHICH WOULD INVOLVE COLLECTING SAMPLES OF LANDFILLED MATERIAL, WAS NOT WARRANTED.

US EPA USED A VARIETY OF SOURCES, OTHER THAN SAMPLING, TO OBTAIN INFORMATION ABOUT WASTES DISPOSED OF IN BOWERS LANDFILL. THESE SOURCES INCLUDED HISTORICAL AERIAL PHOTOGRAPHS, INFORMATION FROM OEPA FILES, INFORMATION PROVIDED BY PRPS, AND INTERVIEWS WITH FORMER OWNERS, OPERATORS, AND USERS OF THE LANDFILL. A COMPLETE INVENTORY OF MATERIAL DEPOSITED IN THE LANDFILL CANNOT BE PREPARED BECAUSE ACCURATE, DOCUMENTED RECORDS OF LANDFILLING ACTIVITIES DO NOT EXIST. ADDITIONALLY, INTERVIEWS WITH FORMER OWNERS, OPERATORS, AND USERS WERE CONDUCTED 15 TO 20 YEARS AFTER LANDFILLING ENDED. THUS, THE INFORMATION OBTAINED FROM THESE INTERVIEWS MAY NOT BE COMPLETELY ACCURATE.

PERSONS INTERVIEWED STATED THAT BOWERS LANDFILL ACCEPTED INDUSTRIAL WASTES, INCLUDING BARRELS CONTAINING LIQUIDS AND LIQUIDS FROM TANK TRUCKS. SOME OF THESE LIQUIDS MAY HAVE BEEN HAZARDOUS SUBSTANCES. NEVERTHELESS, MUCH OF THE INDUSTRIAL WASTE ACCEPTED BY BOWERS LANDFILL CONSISTED OF GENERAL TRASH AND OTHER NONHAZARDOUS WASTES. INFORMATION FROM OEPA FILES (FORMERLY THE OHIO DEPARTMENT OF HEALTH) STATES THAT THE MAJORITY OF MATERIALS PLACED IN THE LANDFILL CONSIST OF RESIDENTIAL WASTES COLLECTED BY PRIVATE HAULERS IN THE CIRCLEVILLE AREA.

IN RESPONSE TO A 1978 INVESTIGATION BY THE US HOUSE OF REPRESENTATIVE SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATION, DUPONT AND PPG REPORTED DISPOSAL OF 6,000 AND 1,700 TONS OF WASTE, RESPECTIVELY, IN BOWERS LANDFILL BETWEEN 1965 AND 1968. US EPA REQUESTED ADDITIONAL INFORMATION FROM DUPONT AND PPG IN 1988 UNDER SECTION 104(E) OF CERCLA. BOTH COMPANIES STATED THAT THEY DID NOT RETAIN WASTE SHIPMENT RECORDS FROM THE 1960S AND THAT PREVIOUS ESTIMATES OF WASTE VOLUMES REPRESENTED THE BEST INFORMATION AVAILABLE. EACH COMPANY INTERVIEWED EMPLOYEES WHO WORKED AT THE CIRCLEVILLE PLANTS DURING THE 1960S TO OBTAIN ADDITIONAL INFORMATION ON WASTE DISPOSAL FROM THAT PERIOD. DUPONT STATED THAT MOST OF THE 6,000 TONS OF WASTES SENT TO BOWERS LANDFILL CONSISTED OF MYLAR POLYESTER FILM. PPG RESPONDED THAT WASTES SENT TO BOWERS LANDFILL MAY HAVE INCLUDED DEFECTIVE RESIN PRODUCTS, USED FILTER MATERIALS, RESIN-SATURATED PHOSPHATE SALTS, SPENT CLEANING MATERIALS, AND CAUSTIC SOLUTIONS.

2. US EPA RECEIVED SEVERAL QUESTIONS AND COMMENTS RELATED TO THE POTENTIAL MIGRATION OF GROUND-WATER CONTAMINATION SOUTH OF BOWERS LANDFILL. THESE COMMENTS INCLUDED STATEMENTS BY SEVERAL MEMBERS OF ACTION THAT ONE REASON FOR THE DIFFERENCE BETWEEN RI/FS RESULTS AND THE 1981 FINDINGS OF BURGESS AND NIPLE MAY, IN PART, BE THE OFF-SITE MIGRATION OF A CONTAMINANT PLUME TO THE SOUTH. SINCE THE CITY OF CIRCLEVILLE'S WATER SUPPLY WELLS ARE LOCATED 1 1/2 MILES SOUTH OF THE LANDFILL, RESIDENTS WERE CONCERNED ABOUT THIS POSSIBILITY. RESIDENTS WERE PARTICULARLY CONCERNED WITH MOVEMENT OF WATER IN THE LOWER AQUIFER AT THE SITE, AND SUGGESTED THAT IS UNLIKELY THAT WATER FROM THE AQUIFER DISCHARGES UPWARD INTO THE SCIOTO RIVER.

US EPA RESPONSE: THE RI INVESTIGATED TWO WATER BEARING AQUIFERS BELOW THE SITE. THESE TWO UNITS ARE SEPARATED WEST OF THE LANDFILL BY A LOW-PERMEABILITY LAYER. GROUND WATER IN THE UPPER AQUIFER FLOWS WEST TOWARD THE SCIOTO RIVER AND PROBABLY DISCHARGES INTO THE RIVER. GROUND WATER IN THE LOWER AQUIFER FLOWS SOUTHWEST TOWARD THE RIVER. THE POTENTIOMETRIC SURFACE (THE LEVEL TO WHICH THE WATER WILL RISE) OF THE LOWER AQUIFER IS HIGHER THAN THAT OF THE UPPER AQUIFER AND ABOUT THE SAME AS THE WATER LEVEL IN THE SCIOTO RIVER. THUS, GROUND WATER IN THE LOWER AQUIFER MAY MOVE UPWARD TOWARD THE RIVER. HOWEVER, THE LOW-PERMEABILITY LAYER THAT SEPARATES THE TWO AQUIFERS MAY UNDERLIE THE RIVER AND RESTRICT UPWARD MOVEMENT OF GROUND WATER INTO THE RIVER. IN THIS CASE, GROUND WATER FROM THE LOWER AQUIFER WILL CONTINUE TO MOVE SOUTHWEST. THIS GROUND WATER MAY EVENTUALLY FLOW SOUTHWARD ALONG THE SCIOTO RIVER, WHICH IS LIKELY A GROUND-WATER DIVIDE. IF THE LOW-PERMEABILITY LAYER IS NOT CONTINUOUS, GROUND WATER IN THE LOWER AQUIFER WOULD LIKELY DISCHARGE UPWARD INTO THE SCIOTO RIVER.

CIRCLEVILLE'S WATER SUPPLY COMES FROM A WELLFIELD, LOCATED 1 1/2 MILES SOUTH OF BOWERS LANDFILL. A NUMBER OF PRIVATE WELLS AND THE STURM AND DILLARD QUARRY ARE LOCATED BETWEEN THE SITE AND THE CITY'S WATER SUPPLY. TWO PRIVATE WELLS, LOCATED BETWEEN THE SITE AND THE QUARRY, WERE SAMPLED DURING THE RI. NO CONTAMINATION WAS DETECTED IN THESE WELLS. THESE WELLS AND FOUR ADDITIONAL WELLS, INCLUDING THREE WELLS AT THE STURM AND DILLARD QUARRY, WERE SAMPLED DURING THE 1981 BURGESS AND NIPLE STUDY. ALTHOUGH THE VALIDITY OF THE BURGESS AND NIPLE DATA IS NOT COMPLETELY KNOWN, NO ORGANIC CONTAMINANTS WERE DETECTED IN SAMPLES FROM THESE WELLS. IN ADDITION, THE CITY OF CIRCLEVILLE HAS ANALYZED SAMPLES FROM ITS DRINKING WATER SUPPLY WELLS FROM 1980 TO THE PRESENT. THESE RESULTS WERE REVIEWED AS PART OF THE EA. NONE OF THE RESULTS INDICATE THAT BOWERS LANDFILL HAS IMPACTED THE CITY'S WATER SUPPLY.

3. ONE MEMBER OF ACTION STATED THAT THE REMEDIAL INVESTIGATION WAS CONDUCTED "IN THE MIDDLE OF THE WORST DROUGHT TO AFFECT THIS AREA IN THE PAST 60 YEARS." HE FELT THAT THESE CONDITIONS COULD HAVE AFFECTED THE RESULTS AND CONCLUSIONS OF THE RI.

US EPA RESPONSE: CLIMATOLOGICAL DATA FROM THE CIRCLEVILLE AREA DOES NOT SUPPORT THIS STATEMENT. DATA FROM THE NATIONAL WEATHER SERVICE IN COLUMBUS, OHIO, APPROXIMATELY 25 MILES NORTH OF BOWERS LANDFILL, INDICATE AN AVERAGE ANNUAL PRECIPITATION OF APPROXIMATELY 36.97 INCHES. FOR THE YEARS 1985 THROUGH 1988, ANNUAL PRECIPITATION AT COLUMBUS WAS 38.67, 35.04, 26.70, AND 36.57 INCHES RESPECTIVELY. THESE DATA DO NOT SUGGEST EXTREME DROUGHT CONDITIONS, AND, WITH THE EXCEPTION OF 1987, PRECIPITATION IN THE AREA NEAR BOWERS

LANDFILL WAS NEAR AVERAGE VALUES.

THE FIRST ROUND OF GROUND-WATER, SURFACE WATER, AND SEDIMENT SAMPLING WAS CONDUCTED IN FEBRUARY 1987; THE SECOND ROUND WAS CONDUCTED IN APRIL AND MAY 1987; AND THE SUPPLEMENTAL ROUND WAS CONDUCTED IN MARCH 1988. NONE OF THESE EVENTS OCCURRED FOLLOWING PERIODS OF ABNORMALLY LOW PRECIPITATION. THE FIRST ROUND OF SAMPLING ACTUALLY FOLLOWED A PERIOD OF RELATIVELY HIGH PRECIPITATION, AS THE LANDFILL WAS FLOODED IN DECEMBER 1986. ADDITIONAL INFORMATION ON PRECIPITATION AND RIVER STAGE DATA DURING SAMPLING EVENTS IS PRESENTED IN DRAWINGS 3-15 AND 3-16 OF THE RI REPORT.

4. ONE RESIDENT ASKED WHY THE GROUND-WATER STUDY DURING REMEDIAL INVESTIGATION WAS CONFINED IN THE SITE VICINITY AND DID NOT STUDY REGIONAL GROUND-WATER FLOW. RESIDENTS ALSO ASKED WHY THE REMEDIAL INVESTIGATION DID NOT INCLUDE (1) TESTING OF WELLS SOUTH OF BOWERS LANDFILL AND (2) INSTALLATION AND TESTING OF WELLS ON THE WEST SIDE OF THE SCIOTO RIVER.

US EPA RESPONSE: THE RI WAS NOT STRICTLY LIMITED TO STUDY THE SITE.

OFF-SITE RESIDENTIAL WELLS, INCLUDING TWO WELLS SOUTH OF BOWERS LANDFILL (BETWEEN THE LANDFILL AND THE CITY OF CIRCLEVILLE WATER SUPPLY), WERE SAMPLED. SAMPLES FROM THESE WELLS, AS WELL AS SAMPLES FROM GROUND-WATER MONITORING WELLS, SHOWED VERY LITTLE CONTAMINATION. AS A RESULT, THE MONITORING WELL NETWORK WAS NOT EXTENDED SOUTH OR WEST DURING THE RI.

US EPA WILL EXTEND THE MONITORING WELL NETWORK AS PART OF THE REMEDIAL ACTION FOR BOWERS LANDFILL. THE EXTENDED NETWORK WILL INCLUDE ADDITIONAL MONITORING WELLS SOUTH OF THE LANDFILL, ADDITIONAL WELLS BETWEEN THE LANDFILL AND THE SCIOTO RIVER, AND, IF NECESSARY, ADDITIONAL WELLS WEST OF THE RIVER.

5. ONE MEMBER OF ACTION QUESTIONED A STATEMENT IN THE RI REPORT ABOUT POTENTIAL SOURCES OF TETRACHLOROETHENE IN AN UPGRADIENT MONITORING WELL.

US EPA RESPONSE: TETRACHLOROETHENE WAS FOUND IN TWO GROUND-WATER SAMPLES COLLECTED FROM UPGRADIENT WELL W-12. CONTAMINANTS FOUND IN THIS WELL ARE NOT LIKELY TO HAVE BEEN CAUSED BY THE LANDFILL. THE RI REPORT (PAGE 5-8) SPECULATED THAT THE TETRACHLOROETHENE FOUND IN SAMPLES MAY HAVE ORIGINATED FROM EQUIPMENT MAINTENANCE ACTIVITIES ASSOCIATED WITH THE NEARBY SAND AND GRAVEL QUARRYING OPERATIONS. TETRACHLOROETHENE IS A COMMON SOLVENT AND IS WIDELY USED AS A DEGREASER FOR METAL MACHINE PARTS.

6. ONE MEMBER OF ACTION ASKED WHY THE RI REPORT DID "NOT SPECULATE WHAT WILL HAPPEN TO GROUNDWATER FLOW AND THE CONTAMINANTS THE WATER CONTAINS SHOULD ADJACENT QUARRYING OPERATIONS REACH BELOW THE WATER TABLE AS THEY HAVE SOUTH OF THE SITE."

US EPA RESPONSE: US EPA DOES NOT BELIEVE THAT QUARRYING ACTIVITIES NEAR BOWERS LANDFILL ARE LIKELY TO AFFECT REGIONAL GROUND-WATER FLOW. QUARRYING ACTIVITIES ARE CONTINUING EAST AND NORTHEAST OF THE SITE. AT THE TIME OF THE RI, THESE QUARRYING ACTIVITIES HAD REACHED THE WATER TABLE NORTHEAST OF THE LANDFILL. POTENTIOMETRIC SURFACE MAPS OF THE UPPER AQUIFER INDICATE THAT FLOW IS WEST TOWARD THE SCIOTO RIVER, IN SPITE OF THE QUARRYING ACTIVITIES TO THE NORTHEAST.

MONITORING WELLS EAST AND NORTH OF THE LANDFILL WILL BE INCLUDED IN THE LONG-TERM GROUND-WATER MONITORING PROGRAM FOR BOWERS LANDFILL. WATER LEVEL MEASUREMENTS FROM THESE AND OTHER WELLS IN THE MONITORING NETWORK WILL DETECT ANY POTENTIAL CHANGES IN GROUND-WATER FLOW DIRECTION CAUSED BY FUTURE QUARRYING ACTIVITIES.

7. ONE MEMBER OF ACTION ASKED WHY GROUND-WATER SAMPLES WERE NOT COLLECTED FROM MONITORING WELLS THAT EXHIBITED ELEVATED ORGANIC VAPOR READINGS IN THE WELL CASINGS.

US EPA RESPONSE: DURING THE RI, A FLAME IONIZATION DETECTOR (FID) WAS USED TO MEASURE ORGANIC VAPOR CONCENTRATIONS AT THE TOP OF EACH WELL CASING, PRIOR TO PURGING OR SAMPLING THE WELL. THIS PROCEDURE WAS USED PRIMARILY TO PROTECT THE HEALTH AND SAFETY OF WORKERS SAMPLING THE WELLS.

ONLY ONE WELL, P-6B, SHOWED ELEVATED ORGANIC VAPOR READINGS. THIS WELL WAS SAMPLED IN FEBRUARY 1987, APRIL 1987, AND MARCH 1988. ONLY THREE ORGANIC COMPOUNDS WERE FOUND DURING THESE SAMPLING ROUNDS: BENZENE (2

SAMPLING ROUNDS, MAXIMUM CONCENTRATION OF 6 UG/L); ACETONE (2 SAMPLING ROUNDS, MAXIMUM CONCENTRATION OF 64 UG/L), AND 2-METHYLNAPHTHALENE (1 SAMPLING ROUND, MAXIMUM CONCENTRATION OF 2.8 UG/L).

8. ONE MEMBER OF ACTION SUGGESTED THAT "BACKGROUND" SAMPLES FOR SURFACE WATER AND SEDIMENT WERE COLLECTED FROM LOCATIONS THAT COULD HAVE BEEN AFFECTED BY RUNOFF FROM THE LANDFILL DURING HEAVY RAINS OR FLOODING.

US EPA RESPONSE: BACKGROUND SAMPLES FOR SURFACE WATER AND SEDIMENT WERE COLLECTED FROM THE EAST SIDE OF THE SCIOTO RIVER, UPSTREAM OF BOWERS LANDFILL. SAMPLE RESULTS FROM THESE LOCATIONS ARE NOT LIKELY TO HAVE BEEN INFLUENCED BY THE LANDFILL. SURFACE WATER SAMPLES WERE NOT COLLECTED DURING FLOODING, BUT AT A TIME WHEN WATER WAS FLOWING FROM THE BACKGROUND SAMPLING LOCATION TOWARD THE LANDFILL. PAST FLOODS COULD POSSIBLY HAVE CARRIED BACKGROUND CONTAMINATED SOIL FROM THE LANDFILL, CONTAMINATING SEDIMENTS AWAY FROM THE LANDFILL. HOWEVER, THE BACKGROUND LOCATION WOULD HAVE BEEN AFFECTED BY THIS PROCESS ONLY IF SUBSTANTIAL BACK-MIXING OF FLOOD WATERS (FLOW IN THE UPSTREAM DIRECTION) OCCURRED. US EPA CONSIDERS THIS UNLIKELY.

9. DURING THE REMEDIAL INVESTIGATION, THE BOWERS LANDFILL INFORMATION COMMITTEE REQUESTED THAT ADDITIONAL MONITORING WELLS BE INSTALLED TO CLARIFY GROUND-WATER DIRECTION IN THE LOWER AQUIFER AT THE SITE.

US EPA RESPONSE: US EPA RESPONDED TO THE INFORMATION COMMITTEE'S REQUEST AND REQUIRED THE INSTALLATION AND SAMPLING OF TWO ADDITIONAL DEEP WELLS (P-12B AND P-13B). THESE WELLS WERE INSTALLED IN FEBRUARY 1988 AND SAMPLED IN MARCH 1988. INFORMATION FROM THESE TWO WELLS AND OTHER PREVIOUSLY INSTALLED DEEP WELLS INDICATED THAT GROUND WATER IN THE LOWER AQUIFER FLOWS SOUTHWEST FROM THE LANDFILL.

4.7 ENDANGERMENT ASSESSMENT ISSUES

1. TWO MEMBERS OF ACTION ASKED WHY THE ENDANGERMENT ASSESSMENT (EA) DID NOT CONSIDER PREVIOUS SAMPLING RESULTS FROM 1981. THESE COMMENTS FOCUSED ON A 1981 STUDY OF BOWERS LANDFILL CONDUCTED BY BURGESS AND NIPLE. GROUND-WATER SAMPLES COLLECTED DURING THIS STUDY SHOWED HIGH LEVELS OF TOLUENE, XYLENE, AND ETHYLBENZENE IMMEDIATELY DOWNGRADIENT OF THE LANDFILL. COMMENTERS WERE CONCERNED THAT INCLUSION OF THESE RESULTS WOULD GREATLY AFFECT THE CONCLUSIONS OF THE EA REPORT.

US EPA RESPONSE: AS DISCUSSED ON PAGE 1-14 OF THE EA REPORT, US EPA DID NOT EVALUATE THE BURGESS AND NIPLE DATA FOR TWO REASONS. FIRST, THE DATA WERE COLLECTED 6 YEARS PRIOR TO THE REMEDIAL INVESTIGATION. WHILE THESE DATA MAY REPRESENT PAST SITE CONDITIONS, THE RI DATA MORE ACCURATELY ASSESS CURRENT SITE CONDITIONS. SECOND, US EPA COULD NOT ASSURE THE QUALITY OF THE BURGESS AND NIPLE DATA.

SUPERFUND ENDANGERMENT ASSESSMENTS SHOULD BE BASED ONLY ON VALIDATED SAMPLE RESULTS. THE BURGESS AND NIPLE RESULTS WERE NOT VALIDATED AND WERE, IN SOME CASES, CONTRADICTIONARY. FOR EXAMPLE, SAMPLES COLLECTED FROM DOWNGRADIENT WELL MW-2 ON JULY 17, 1981, SHOWED HIGH LEVELS OF ETHYLBENZENE, TOLUENE, AND XYLENE WHEN ANALYZED BY GAS CHROMATOGRAPHY (GC). CONCENTRATIONS OF THESE THREE CHEMICALS WERE 66.8, 43.4, AND 27 MG/L, RESPECTIVELY. HOWEVER, WHEN THE SAME SAMPLES WERE ANALYZED BY A DIFFERENT METHOD, GAS CHROMATOGRAPHY/MASS SPECTROSCOPY (GC/MS), CONCENTRATIONS WERE MUCH LOWER. ETHYLBENZENE AND TOLUENE CONCENTRATIONS MEASURED BY GC/MS WERE 2.48 AND 2.53 MG/L, RESPECTIVELY, OR 15 TO 25 TIMES LOWER THAN THE GC RESULTS. (XYLENE WAS EITHER NOT MEASURED, NOT DETECTED BY GC/MS, OR NOT REPORTED.

HOWEVER, EVEN IF THE EA HAD INCLUDED THE BURGESS AND NIPLE DATA, THE CONCLUSIONS OF THIS REPORT WOULD NOT HAVE BEEN AFFECTED. THE DATA WOULD STILL SHOW A POTENTIAL RISK FROM USING GROUND WATER BETWEEN THE LANDFILL AND THE SCIOTO RIVER AS A DRINKING WATER SUPPLY. IF THE HIGHEST OF BURGESS AND NIPLE'S RESULTS WERE CONSIDERED, RISK LEVELS WOULD BE SOMEWHAT HIGHER THAN THOSE ESTIMATED IN THE EA. THE HAZARD INDEX, REFLECTING NONCARCINOGENIC RISKS, WOULD INCREASE FROM 1.04 TO APPROXIMATELY 29. WORST-CASE CARCINOGENIC RISKS WOULD INCREASE FROM 9×10^{-6} TO 3×10^{-5} .

AN EA BASED ON THE BURGESS AND NIPLE RESULTS WOULD STILL CONCLUDE THAT OFF-SITE RESIDENTIAL WELLS WERE UNAFFECTED BY THE LANDFILL. BURGESS AND NIPLE SAMPLED SIX PRIVATE WELLS SOUTH OF BOWERS LANDFILL SHORTLY AFTER HIGH LEVELS OF ETHYLBENZENE, TOLUENE, AND XYLENE WERE FOUND IN ON-SITE WELLS. THE PRIVATE RESULTS SHOWED NO EVIDENCE OF CONTAMINATION.

2. ONE MEMBER OF ACTION WANTED TO KNOW WHY US EPA HAS COMPROMISED PUBLIC SAFETY BY ALLOWING A CANCER RISK OF 1 IN 10,000 FOR THE SITE, A LEVEL "UP TO 100 TIMES GREATER RISK THAN THAT GENERALLY ACCEPTED."

US EPA RESPONSE: THIS QUESTION APPEARS TO BE BASED ON A MISUNDERSTANDING OF INFORMATION PRESENTED IN THE EA REPORT. US EPA HAS NOT ALLOWED A CANCER RISK OF 1 IN 10,000 FOR THE SITE. THE EA REPORT STATED THAT RECENT US EPA GUIDANCE SUGGESTS THAT A TARGET RANGE FOR CARCINOGENIC RISKS OF 10^{-4} (1 CANCER PER 10,000 PEOPLE EXPOSED) TO 10^{-7} (1 CANCER PER 10 MILLION PEOPLE EXPOSED) SHOULD BE CONSIDERED AT SUPERFUND SITES. WITHIN THIS RANGE, A RISK OF 10^{-6} (1 CANCER PER 1 MILLION PEOPLE EXPOSED) IS GENERALLY CONSIDERED A BENCHMARK FOR DETERMINING WHETHER SITE CONDITIONS POSE A SIGNIFICANT RISK. HOWEVER, US EPA POLICY IS TO EVALUATE RISK LEVELS AT EACH SUPERFUND SITE BASED ON SITE-SPECIFIC CONDITIONS.

IN THE CASE OF BOWERS LANDFILL, THE EA REPORT ESTIMATED THAT WORST CASE RISKS (BASED ON MAXIMUM CONTAMINANT CONCENTRATIONS AND MAXIMUM EXPOSURE LEVELS) WERE WITHIN THE TARGET RANGE. CARCINOGENIC RISKS WERE ESTIMATED AT 9×10^{-6} FOR INGESTION OF GROUND WATER ADJACENT TO THE SITE AND 3×10^{-6} FOR INGESTION OF ON-SITE SOILS. THE REMEDIAL ALTERNATIVE PROPOSED FOR BOWERS LANDFILL SHOULD ELIMINATE CANCER RISKS FROM GROUND-WATER INGESTION. BY COVERING MOST CONTAMINATED SOILS, THE ALTERNATIVE SHOULD REDUCE CANCER RISKS FROM SOIL INGESTION TO 4×10^{-8} .

3. ONE RESIDENT WAS CONCERNED THAT WHILE THE EA REPORT EVALUATED HEALTH EFFECTS OF INDIVIDUAL CHEMICALS, THE REPORT DID NOT EVALUATE THE EFFECTS OF COMBINATIONS OF CHEMICALS, PARTICULARLY SYNERGISTIC EFFECTS.

US EPA RESPONSE: APPROXIMATELY 60 CHEMICALS HAVE BEEN IDENTIFIED IN SAMPLES COLLECTED FROM VARIOUS ENVIRONMENTAL MEDIA AT BOWERS LANDFILL. BECAUSE OF THIS LARGE NUMBER, IT IS NOT POSSIBLE TO IDENTIFY AND CHARACTERIZE ALL POSSIBLE INTERACTIONS OF THESE CHEMICALS, WHETHER THE INTERACTIONS ARE SYNERGISTIC, ANTAGONISTIC, OR OTHERWISE. THE EA WAS CONDUCTED ACCORDING TO ESTABLISHED US EPA GUIDANCE. THIS GUIDANCE REQUIRES THAT WAS CONDUCTED ACCORDING TO ESTABLISHED US EPA GUIDANCE. THIS GUIDANCE REQUIRES THAT WHEN CHEMICAL INTERACTIONS CANNOT BE ADEQUATELY CHARACTERIZED, ADDITIVITY SHOULD BE ASSUMED. THAT IS, THE COMBINED EFFECTS OF TWO CHEMICALS SHOULD BE ESTIMATED AS THE SUM OF THE INDIVIDUAL EFFECTS OF EACH CHEMICAL. THE EA FOLLOWED THIS PROCEDURE. FOR EACH EXPOSURE ROUTE, THE EFFECTS OF EXPOSURE TO MULTIPLE CONTAMINANTS WERE ESTIMATED BY SUMMING THE RISKS FOR EACH INDIVIDUAL CONTAMINANT.

4. ONE MEMBER OF ACTION EXPRESSED CONCERN THAT THE ENDANGERMENT ASSESSMENT DID NOT CONSIDER THE POSSIBILITY "THAT FLOODING MIGHT DISTRIBUTE CONTAMINANTS AND CONTAMINATED SOIL FROM THE LANDFILL."

US EPA RESPONSE: CONTAMINANTS FROM BOWERS LANDFILL, PARTICULARLY THOSE IN SITE SOILS AND SEDIMENTS, COULD BE DISTRIBUTED TO OFF-SITE AREAS BY FLOODING. HOWEVER, TRANSPORT AND DISTRIBUTION OF THESE CONTAMINANTS BY LARGE VOLUMES OF FLOODWATERS WOULD GREATLY REDUCE CONCENTRATIONS COMPARED TO ON-SITE LEVELS. RISKS TO HUMAN HEALTH AND THE ENVIRONMENT OFF-SITE WOULD BE CORRESPONDINGLY REDUCED COMPARED TO ON-SITE RISKS.

THE EA ESTIMATED ON-SITE RISKS RELATIVELY LOW LEVELS, EVEN UNDER WORST CASE EXPOSURE CONDITIONS OFF-SITE RISKS, DUE TO POSSIBLE CONTAMINANT DISTRIBUTION BY FLOODS, SHOULD BE SUBSTANTIALLY LESS AND WELL BELOW LEVELS OF CONCERN.

5. ONE MEMBER OF ACTION STATED THAT WORST CASE EXPOSURE SCENARIOS EVALUATED IN THE ENDANGERMENT ASSESSMENT WEREN'T "REALLY WORST CASES." INHALATION OR INGESTION OF DUSTS WHILE FARMING THE FIELD NEXT TO THE LANDFILL AND INGESTION OF WATER FROM DITCHES NEXT TO THE LANDFILL WERE MENTIONED AS SPECIFIC CONCERNS.

US EPA RESPONSE: THE EA EVALUATED HUMAN EXPOSURE TO CONTAMINANTS AT OR RELEASED FROM BOWERS LANDFILL UNDER PROBABLE CASE AND WORST CASE CONDITIONS. EXPOSURE SCENARIOS WERE DEVELOPED TO REFLECT EXPOSURE CONDITIONS THAT MIGHT REASONABLY BE EXPECTED TO OCCUR AT OR NEAR BOWER LANDFILL. THIS WAS DONE TO IDENTIFY A REALISTIC RANGE OF RISKS TO HUMAN HEALTH POSED BY THE LANDFILL. "REALLY WORST CASES" COULD BE DEVELOPED WHICH WOULD RESULT IN GREATER EXPOSURES AND LARGER ESTIMATED RISKS TO HUMAN HEALTH THAN FOR THE REALISTIC WORST CASES PRESENTED IN THE EA. HOWEVER, SUCH EXPOSURE SCENARIOS ARE HIGHLY UNLIKELY TO OCCUR.

FOR EXAMPLE, EXTENSIVE SWIMMING IN OR LIFETIME INGESTION OF SURFACE WATER FROM ON-SITE DRAINAGE DITCHES IT THEORETICALLY POSSIBLE. HOWEVER, THE DITCHES ARE SHALLOW AND FILLED WITH DEBRIS, CONDITIONS THAT MAKE THEM UNATTRACTIVE AS A SWIMMING LOCATION OR DRINKING WATER SOURCE. FURTHERMORE, THE GENERAL PUBLIC NEAR THE

LANDFILL IS WELL AWARE THAT THE DITCHES ARE ADJACENT TO A KNOWN HAZARDOUS WASTE SITE. THEREFORE, THE THEORETICAL "REALLY WORST CASE" EXPOSURE IS EXTREMELY UNLIKELY. THE INFREQUENT AND INCIDENTAL EXPOSURE TO THESE WATERS, AS PRESENTED IN THE EA, IS A MORE REALISTIC WORST CASE EXPOSURE SCENARIO.

AS A SECOND EXAMPLE, REGULAR EXPOSURE TO LARGE VOLUMES OF CONTAMINATED DUST (GENERATED BY AGRICULTURAL ACTIVITIES IN THE FIELD WEST OF BOWERS LANDFILL) IS THEORETICALLY POSSIBLE. SOILS FROM THIS FIELD CONTAINED LEAD CONCENTRATIONS ABOVE BACKGROUND LEVELS. THE NATIONAL AMBIENT AIR QUALITY STANDARD FOR LEAD OF 0.0015 MG/M(3) REPRESENTS A SAFE LEVEL FOR THE GENERAL POPULATION. HOWEVER, THE EA ESTIMATED THAT EVEN IF ALL AGRICULTURAL LAND WAS CONTAMINATED AT THE HIGHEST OBSERVED LEAD CONCENTRATION, A TOTAL DUST CONCENTRATION OF 15 MG OF DUST PER CUBIC METER OF AIR (MG/M(3)) WOULD BE NEEDED BEFORE LEAD CONCENTRATIONS EXCEEDED SAFE LEVELS. IT IS HIGHLY UNLIKELY THAT SUCH DUST CONCENTRATIONS COULD BE GENERATED FOR ANY LENGTH OF TIME, AND AGRICULTURAL WORKERS WOULD BE EXPOSED ONLY INTERMITTENTLY. EXPOSURE OF OFF-SITE POPULATIONS WOULD BE LESS BECAUSE DUST CONCENTRATIONS WOULD DECREASE DURING TRANSPORT. THUS, AS WITH SURFACE WATER, THEORETICAL "REALLY WORST CASE" EXPOSURE TO CONTAMINATED DUSTS IS HIGHLY UNLIKELY.

6. ONE MEMBER OF ACTION ASKED WHY THE ENDANGERMENT ASSESSMENT IGNORED THE POSSIBILITY OF SOUTHWARD MIGRATION OF GROUND-WATER CONTAMINATION.

US EPA RESPONSE: THE EA STATED THAT OFF-SITE RESIDENTIAL WELLS OR THE CITY OF CIRCLEVILLE PUBLIC WATER SUPPLY WELLS HAVE PROBABLY NOT BEEN AFFECTED BY SOUTHWARD MIGRATION OF GROUND-WATER CONTAMINATION FROM BOWERS LANDFILL. HOWEVER, THE EA DID NOT IGNORE THIS POSSIBILITY. TABLE 3-1 OF THE EA PRESENTS WATER QUALITY SAMPLING RESULTS FOR CIRCLEVILLE'S WATER SYSTEM. THE RESULTS, COLLECTED BETWEEN 1980 AND 1987, SHOW THAT WATER FROM CIRCLEVILLE'S WELLS IS OF HIGH QUALITY AND HAS NOT BEEN AFFECTED BY CONTAMINATION FROM THE LANDFILL. MORE RECENT AND EXTENSIVE DATA FROM 1988, UNAVAILABLE WHEN THE EA REPORT WAS WRITTEN, CONFIRM THIS CONCLUSION. SAMPLING RESULTS FROM RESIDENTIAL WELLS SOUTH OF THE LANDFILL WERE ALSO PRESENTED IN THE EA REPORT. SAMPLES COLLECTED FROM THESE WELLS IN FEBRUARY 1987 SHOWED NO EVIDENCE OF CONTAMINATION.

4.8 OTHER ISSUES

1. ONE MEMBER OF ACTION WANTED TO KNOW WHY THE SIZE OF BOWERS LANDFILL WAS LISTED AS 80 ACRES IN 1980, BUT ONLY 12 ACRES IN SUBSEQUENT REPORTS.

US EPA RESPONSE: THE 12-ACRE FIGURE REFERS TO THE AREA WHERE WASTES WERE DEPOSITED. THIS L-SHAPED AREA, SHOWN IN VARIOUS SITE DRAWINGS, IS APPROXIMATELY 4,000 FEET LONG AND 125 FEET WIDE. THE 80-ACRE FIGURE REFERS TO THE ENTIRE SITE AREA, INCLUDING THE LANDFILL, DRAINAGE DITCH TO THE EAST, AND THE AGRICULTURAL FIELD TO THE WEST. THIS AREA WILL BE ENCLOSED BY A FENCE AS PART OF THE REMEDIAL ACTION.

2. ONE MEMBER OF THE COMMUNITY EXPRESSED HEALTH CONCERNS ABOUT "A HIGHER THAN NORMAL INCIDENCE OF SICKNESS" NEAR THE LANDFILL. ANOTHER MEMBER OF THE COMMUNITY ASKED WHETHER US EPA "HAS DONE ANY STUDIES TO SEE IF THE INCIDENCE OF CANCER AND LEUKEMIA IN THE YOUTH OF CIRCLEVILLE IS GREATER THAN IN SIMILARLY SIZED TOWNS ELSEWHERE."

US EPA RESPONSE: US EPA HAS NOT CONDUCTED ANY EPIDEMIOLOGICAL STUDIES OF THIS TYPE AT BOWERS LANDFILL. THESE STUDIES ARE NORMALLY CONDUCTED BY THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR). BASED ON SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986, ATSDR IS REQUIRED TO PERFORM A HEALTH ASSESSMENT AT EACH SUPERFUND SITE. THE HEALTH ASSESSMENT IS CONDUCTED INDEPENDENTLY OF US EPA'S EA AND IS A PRELIMINARY EVALUATION OF RISKS POSED BY THE SITE. DEPENDING ON THE RESULTS OF THIS ASSESSMENT, ATSDR CAN CONDUCT PILOT STUDIES OF HEALTH EFFECTS FOR SELECTED GROUPS OF EXPOSED INDIVIDUALS OR A FULL-SCALE EPIDEMIOLOGICAL STUDY OF EXPOSED POPULATIONS. ATSDR MAINTAINS AN OFFICE AT US EPA REGION 5 HEADQUARTERS IN CHICAGO. QUESTIONS ON ATSDR'S ROLE AND ON EPIDEMIOLOGICAL STUDIES SHOULD BE DIRECTED TO LOUISE FABINSKI AT THAT OFFICE. SHE CAN BE REACHED AT (312) 353-8228.

5.0 REMAINING CONCERNS

US EPA WAS UNABLE TO COMPLETELY ADDRESS SEVERAL ISSUES DURING REMEDIAL PLANNING ACTIVITIES ASSOCIATED WITH THE RECORD OF DECISION. THESE ISSUES AND CONCERNS ARE SUMMARIZED BELOW.

DETAILS OF THE GROUND-WATER MONITORING PROGRAM. US EPA'S RECORD OF DECISION PROVIDES DETAILS ON SEVERAL ASPECTS OF THE GROUND-WATER MONITORING PROGRAM. THESE DETAILS INCLUDE APPROXIMATE LOCATIONS OF NEW WELLS, THE LIST OF CHEMICALS TO BE SAMPLED, AND THE SAMPLING FREQUENCY. ADDITIONAL DETAILS, INCLUDING THE EXACT NUMBER AND LOCATIONS OF NEW WELLS AND THE WELLS TO BE INCLUDED IN THE GROUND-WATER MONITORING PROGRAM, WILL BE DEVELOPED DURING REMEDIAL DESIGN.

RESPONSE PLAN FOR DETECTION OF CONTAMINANTS IN MONITORING WELLS. CONCERNS WERE RAISED ABOUT THE LACK OF A RESPONSE PLAN IF MONITORING WELLS SHOW INCREASING LEVELS OF CONTAMINATION, ONCE THE CLAY CAP HAS BEEN INSTALLED ON BOWERS LANDFILL. MAJOR ISSUES INCLUDED THE CONTAMINANT LEVELS THAT WOULD TRIGGER A RESPONSE, THE NATURE OF THE RESPONSE, HOW QUICKLY THE RESPONSE WOULD OCCUR, AND WHO WOULD BE TECHNICALLY AND FINANCIALLY RESPONSIBLE FOR THE RESPONSE. US EPA HAS ADDRESSED THESE ISSUES TO THE EXTENT POSSIBLE IN THE RECORD OF DECISION. ADDITIONAL DETAILS WILL BE RESOLVED DURING THE DETAILED DESIGN OF THE SITE REMEDY.

OPERATION AND MAINTENANCE PLAN FOR LANDFILL CAP. SEVERAL RESIDENTS EXPRESSED CONCERN ABOUT PROCEDURES THAT WILL BE USED TO ENSURE THE INTEGRITY OF THE LANDFILL CAP. IN THE RECORD OF DECISION, US EPA HAS PROVIDED A GENERAL DESCRIPTION OF OPERATION AND MAINTENANCE REQUIREMENTS FOR THE CAP. FOR EXAMPLE, THE CAP WILL BE INSPECTED QUARTERLY, AND REPAIRS TO ALL SIGNIFICANT DAMAGE WILL BEGIN WITHIN 30 DAYS. ADDITIONAL SPECIFIC DETAILS MUST BE DETERMINED AFTER THE CAP IS DESIGNED AND CONSTRUCTED. EXAMPLES OF SUCH DETAILS INCLUDE INSPECTION METHODS AND REPORTING PROCEDURES.

CONSTRUCTION OF A FENCE AROUND BOWERS LANDFILL. RESIDENTS REQUESTED THAT A FENCE AROUND THE BOWERS LANDFILL SITE, A COMPONENT OF THE SELECTED REMEDIAL ALTERNATIVE, BE CONSTRUCTED AS SOON AS POSSIBLE. US EPA WILL CONSTRUCT THE FENCE ON A PRIORITY BASIS DURING REMEDIAL ACTION. HOWEVER, THE AGENCY CANNOT PROVIDE A SPECIFIC SCHEDULE FOR FENCING THE SITE AT THIS TIME.

CONTINUATION OF THE BOWERS LANDFILL INFORMATION COMMITTEE. SEVERAL RESIDENTS REQUESTED CONTINUATION OF THE INFORMATION COMMITTEE TO FACILITATE CITIZEN INVOLVEMENT IN THE RD/RA PROCESS. US EPA WILL CONTINUE THE COMMITTEE. HOWEVER, THE EXACT MAKEUP OF THE COMMITTEE WILL DEPEND ON NEGOTIATIONS WITH THE PRPS. THE RESULTS OF THESE NEGOTIATIONS WILL DETERMINE WHO WILL BE RESPONSIBLE FOR DESIGN AND CONSTRUCTION OF THE REMEDIAL ALTERNATIVE, AND, THUS, WHO WILL BE ON THE COMMITTEE.

TABLE 1
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR
CHEMICALS IN GROUND WATER NEAR BOWERS LANDFILL

COMPOUND	UPGRADIENT WELLS			
	FREQUENCY OF DETECTION(1)	ADJUSTED FREQUENCY OF DETECTION(2)	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	16/16	16/16	185	368
LEAD	2/16	1/15	1.2	7.0
MERCURY	2/16	0/16	-	-
BENZENE	0/16	-	-	-
TETRACHLOROETHENE	3/16	3/16	0.89	5.3
CHLORDANE	0/16	-	-	-
PCBS	0/16	-	-	-
4-METHYLPHENOL	0/16	-	-	-
PAHS	0/16	-	-	-

NOTES:

{ } ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 1 (CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR
CHEMICALS IN GROUND WATER NEAR BOWERS LANDFILL

COMPOUND	DOWNGRAIDENT WELLS			
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	37/37	37/37	330	2070
LEAD	8/37	1/27	1.2	6.9
MERCURY	0/37	-	-	-
BENZENE	3/37	3/37	0.7	6.0
TETRACHLOROETHENE	0/37	-	-	-
CHLORDANE	0/37	-	-	-
PCBS	0/37	-	-	-
4-METHYLPHENOL	0/37	-	-	-
PAHS	0/37	-	-	-

NOTES:

{ } ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 1 (CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR
CHEMICALS IN GROUND WATER NEAR BOWERS LANDFILL

COMPOUND	PRE-REMEDIAL WELLS			
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	5/5	5/5	112	{130}
LEAD	0/5	-	-	-
MERCURY	0/5	-	-	-
BENZENE	0/5	-	-	-
TETRACHLOROETHENE	0/5	-	-	-
CHLORDANE	0/5	-	-	-
PCBS	0/5	-	-	-
4-METHYLPHENOL	0/5	-	-	-
PAHS	0/5	-	-	-

NOTES:

{ } ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 2
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR
CHEMICALS IN SURFACE WATER NEAR BOWERS LANDFILL

COMPOUND	SCIOTO RIVER-UPGRADIENT			
	FREQUENCY OF DETECTION(1)	ADJUSTED FREQUENCY OF DETECTION(2)	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	2/2	2/2	56	{60}
LEAD	1/2	0/1	-	-
MERCURY	0/2	-	-	-
BENZENE	0/2	-	-	-
TETRACHLOROETHENE	1/2	1/2	0.74	1.1J
CHLORDANE	0/2	-	-	-
PCBS	1/2	1/2	0.77	1.2
4-METHYLPHENOL	0/2	-	-	-
PAHS	0/2	-	-	-

NOTES:

{},J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -

A = NUMBER OF TIMES A COMPOUND WAS DETECTED

B = TOTAL NUMBER OF SAMPLES

SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 2(CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR
CHEMICALS IN SURFACE WATER NEAR BOWERS LANDFILL

COMPOUND	SCIOTO RIVER-DOWNGRADIENT			
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	9/9	9/9	54	{60}
LEAD	4/9	0/5	-	-
MERCURY	2/9	1/3	0.13	0.20
BENZENE	0/9	-	-	-
TETRACHLOROETHENE	2/9	2/9	0.59	1.1J
CHLORDANE	0/9	-	-	-
PCBS	0/9	-	-	-
4-METHYLPHENOL	0/9	-	-	-
PAHS	0/9	-	-	-

NOTES:

{ },J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -

A = NUMBER OF TIMES A COMPOUND WAS DETECTED

B = TOTAL NUMBER OF SAMPLES

SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 2 (CONTINUED)

**DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR
CHEMICALS IN SURFACE WATER NEAR BOWERS LANDFILL**

DRAINAGE DITCHES
ADJUSTED

COMPOUND	FREQUENCY OF DETECTION	FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	19/19	19/19	101	{199}
LEAD	4/19	1/15	1.3	8.6
MERCURY	1/19	1/5	0.12	-
BENZENE	0/19	-	-	-
TETRACHLOROETHENE	0/19	-	-	-
CHLORDANE	0/19	-	-	-
PCBS	0/19	1/19	0.55	2.6
4-METHYLPHENOL	0/19	-	-	-
PAHS	0/19	-	-	-

NOTES:

{},J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -

A = NUMBER OF TIMES A COMPOUND WAS DETECTED

B = TOTAL NUMBER OF SAMPLES

SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 3
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS
IN SEDIMENTS NEAR BOWERS LANDFILL

COMPOUND	SCIOTO RIVER-UPGRADIENT			
	FREQUENCY OF DETECTION(1)	ADJUSTED FREQUENCY OF DETECTION(2)	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	2/2	2/2	113	118
LEAD	2/2	2/2	31	38
MERCURY	2/2	1/1	-	0.40
BENZENE	0/2	-	-	-
TETRACHLOROETHENE	1/2	1/2	0.74	1.1J
CHLORDANE	0/2	-	-	-
PCBS	1/2	1/2	0.77	1.2
4-METHYLPHENOL	0/2	-	-	-
PAHS	0/2	-	-	-
BENZO(A)ANTHRACENE	2/2	2/2	0.415	0.420 J
BENZO(A)PYRENE	2/2	2/2	0.408	0.450 J
BENZO(B)FLUORANTHENE	2/2	2/2	0.900	0.910
CHRYSENE	2/2	2/2	0.519	0.550
DIBENZO(A,H) ANTHRACENE	2/2	2/2	0.116	0.160 J
INDENO(1,2,3-CD) PYRENE	2/2	2/2	0.275 J	0.290 J

NOTES:

J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

E CONCENTRATION IS ESTIMATED DUE TO PRESENCE OF INTERFERENCE
DURING ANALYSIS

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 3(CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS
IN SEDIMENTS NEAR BOWERS LANDFILL

COMPOUND	SCIOTO RIVER-DOWNGRADIENT			
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	9/9	9/9	106	312
LEAD	9/9	8/8	34	39
MERCURY	9/9	4/4	0.48	0.59
BENZENE	0/9	-	-	-
TETRACHLOROETHENE	0/9	-	-	-
CHLORDANE	2/9	2/9	0.067	0.200
PCBS	0/9	-	-	-
4-METHYLPHENOL	2/9	2/9	0.069	8.600
PAHS				
BENZO(A)ANTHRACENE	8/9	8/9	0.256	3.600
BENZO(A)PYRENE	9/9	9/9	0.217	0.370 J
BENZO(B)FLUORANTHENE	9/9	9/9	0.451	0.750
CHRYSENE	9/9	9/9	0.287	0.480
DIBENZO(A,H)				
ANTHRACENE	1/9	1/9	0.030	0.130 J
INDENO(1,2,3-CD)				
PYRENE	5/9	5/9	0.064	0.250 J

NOTES:

J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

E CONCENTRATION IS ESTIMATED DUE TO PRESENCE OF INTERFERENCE
DURING ANALYSIS

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 3 (CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS
IN SEDIMENTS NEAR BOWERS LANDFILL

COMPOUND	DRAINAGE DITCHES		GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION		
BARIUM	19/19	19/19	128	227 E
LEAD	19/19	15/15	39	104
MERCURY	10/19	6/15	0.14	14
BENZENE	0/19	-	-	-
TETRACHLOROETHENE	0/19	-	-	-
CHLORDANE	2/19	2/19	0.055	0.140
PCBS	5/19	5/19	0.105	2.300
4-METHYLPHENOL	7/19	7/19	0.091	8.100
PAHS				
BENZO(A)ANTHRACENE	11/19	11/19	0.072	0.400 J
BENZO(A)PYRENE	11/19	11/19	0.077	0.400 J
BENZO(B)FLUORANTHENE	13/19	13/19	0.137	1.000
CHRYSENE	12/19	12/19	0.095	0.710
DIBENZO(A,H)				
ANTHRACENE	1/19	1/19	0.027	0.092 J
INDENO(1,2,3-CD)				
PYRENE	8/19	8/19	0.049	0.270 J

NOTES:

J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

E CONCENTRATION IS ESTIMATED DUE TO PRESENCE OF INTERFERENCE
DURING ANALYSIS

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITTS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 4
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS
IN SOILS NEAR BOWERS LANDFILL

COMPOUND	BACKGROUND LOCATIONS			
	FREQUENCY OF DETECTION (1)	ADJUSTED FREQUENCY OF DETECTION (2)	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	2/2	2/2	152	156
LEAD	5/5	5/5	47	74 E
MERCURY	2/2	0/2	-	-
BENZENE	0/2	-	-	-
TETRACHLOROETHENE	0/2	-	-	-
CHLORDANE	0/2	-	-	-
PCBS	0/2	-	-	-
4-METHYLPHENOL	0/2	-	-	-
PAHS				
BENZO(A)ANTHRACENE	2/2	2/2	0.130	0.140 J
BENZO(A)PYRENE	2/2	2/2	0.134	0.150 J
BENZO(B)FLUORANTHENE	2/2	2/2	0.265	0.280 J
CHRYSENE	2/2	2/2	0.160	0.160 J
DIBENZO(A,H)				
ANTHRACENE	0/2	-	-	-
INDENO(1,2,3-CD)				
PYRENE	1/2	1/2	0.047	0.110 J

NOTES:

J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA REQUIRED DETECTION LIMIT

E CONCENTRATION IS ESTIMATED DUE TO PRESENCE OF INTERFERENCE DURING ANALYSIS

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -

A = NUMBER OF TIMES A COMPOUND WAS DETECTED

B = TOTAL NUMBER OF SAMPLES

SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITS SAMPLES FROM WHICH RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN MAXIMUM CONCENTRATIONS.

TABLE 4 (CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS
IN SOILS NEAR BOWERS LANDFILL

COMPOUND	LOCATIONS ON OR ADJACENT TO THE LANDFILL			
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	15/15	15/15	189	287
LEAD	21/21	21/21	78	179
MERCURY	15/15	15/15	0.27	0.43
BENZENE	0/15	-	-	-
TETRACHLOROETHENE	0/15	-	-	-
CHLORDANE	2/15	2/15	0.015	0.210
PCBS	9/15	9/15	0.238	3.600
4-METHYLPHENOL	0/15	-	-	-
PAHS				
BENZO(A)ANTHRACENE	14/15	14/15	0.116	4.300
BENZO(A)PYRENE	12/15	12/15	0.115	4.300
BENZO(B)FLUORANTHENE	11/14	11/14	0.178	8.600
CHRYSENE	14/15	14/15	0.169	5.200
DIBENZO(A,H)				
ANTHRACENE	1/15	1/15	0.026	0.960 J
INDENO(1,2,3-CD)				
PYRENE	11/15	11/15	0.073	2.600

NOTES:

J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

E CONCENTRATION IS ESTIMATED DUE TO PRESENCE OF INTERFERENCE
DURING ANALYSIS

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 4 (CONTINUED)
DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS
IN SOILS NEAR BOWERS LANDFILL

COMPOUND	AGRICULTURAL AREAS			
	FREQUENCY OF DETECTION	ADJUSTED FREQUENCY OF DETECTION	GEOMETRIC MEAN (UG/L)	MAXIMUM CONCENTRATION (UG/L)
BARIUM	7/7	7/7	121	198
LEAD	11/11	11/11	59	102 E
MERCURY	7/7	2/2	0.48	0.58
BENZENE	0/7	-	-	-
TETRACHLOROETHENE	0/7	-	-	-
CHLORDANE	1/7	1/7	0.014	0.110
PCBS	1/7	1/7	0.063	0.240
4-METHYLPHENOL	0/7	-	-	-
PAHS				
BENZO(A)ANTHRACENE	6/7	6/7	0.081	0.210 J
BENZO(A)PYRENE	5/7	5/7	0.088	0.230 J
BENZO(B)FLUORANTHENE	7/7	7/7	0.204	0.510
CHRYSENE	7/7	7/7	0.136	0.240 J
DIBENZO(A,H)				
ANTHRACENE	0/7	-	-	-
INDENO(1,2,3-CD)				
PYRENE	4/7	4/7	0.054	0.160 J

NOTES:

J ESTIMATED VALUE; COMPOUND FOUND AT CONCENTRATION BELOW US EPA
REQUIRED DETECTION LIMIT

E CONCENTRATION IS ESTIMATED DUE TO PRESENCE OF INTERFERENCE
DURING ANALYSIS

- NOT CALCULATED

(1) FREQUENCY OF DETECTION IS DEFINED AS A/B, WHERE -
A = NUMBER OF TIMES A COMPOUND WAS DETECTED
B = TOTAL NUMBER OF SAMPLES
SAMPLE RESULTS WHICH WERE IDENTIFIED BY THE LABORATORY AS DUE
TO BLANK CONTAMINATION ARE NOT COUNTED IN EITHER A OR B.

(2) ADJUSTED FREQUENCY OF DETECTION OMITS SAMPLES FROM WHICH
RESULTS WERE QUESTIONABLE DUE TO QA/QC PROBLEMS; ONLY SAMPLES
INCLUDED IN THIS COLUMN WERE USED TO DETERMINE GEOMETRIC MEAN
MAXIMUM CONCENTRATIONS.

TABLE 5
SUMMARY OF POTENTIALLY SIGNIFICANT RISKS IDENTIFIED FOR
BOWERS LANDFILL

EXPOSURE ROUTE	CA/NCA(1)	CONTAMINANTS
1. INGESTION OF GROUND WATER	NCA	BARIUM
	CA	BENZENE
2. INGESTION OF SURFACE WATER	CA	PCBS
3. INGESTION OF AQUATIC ANIMALS	NCA	MERCURY
4. INGESTION OF SOILS	NCA	LEAD
	CA	TOTAL PAHS(4)
		PCBS
5. DIRECT CONTACT WITH SURFACE WATER BY AQUATIC ANIMALS	NCA	MERCURY

NOTES:

- 1 CA = CARCINOGENIC
NCA = NONCARCINOGENIC
- 2 THE HAZARD INDEX(HI) IS CALCULATED AS THE RATIO OF EXPOSURE DOSE TO ACCEPTABLE DOSE; AN HI 1 INDICATES A POTENTIALLY SIGNIFICANT RISK.
- 3 US EPA GUIDANCE DESCRIBES A TARGET CARCINOGENIC RISK RANGE OF 10(-4) TO 10(-7). RISKS GREATER THAN 10(-4) ARE CONSIDERED "SIGNIFICANT", WHILE RISKS 10(-7) ARE CONSIDERED INSIGNIFICANT. RISKS BETWEEN 10(-4) AND 10(-7) ARE WITHIN THE TARGET RANGE; THEIR SIGNIFICANCE WILL, IN GENERAL, REFLECT SITE SPECIFIC FACTORS.
- 4 CALCULATIONS INCLUDED THE FOLLOWING CARCINOGENIC PAHS:
 BENZO(A)ANTHRACENE, BENZO(A)PYRENE, BENZO(B)FLUORANTHENE, CHRYSENE, DIBENZO(A,H)ANTHRACENE, AND INDENO(1,2,2-CD)PYRENE.
 THE INCREMENTAL CARCINOGENIC RISK FOR TOTAL PAHS WAS CALCULATED BY MULTIPLYING THE MAXIMUM CONCENTRATION OF EACH PAH OTHER THAN BENZO(A)PYRENE BY A RELATIVE POTENCY FACTOR TO BENZO(A)PYRENE. THE ADJUSTED CONCENTRATIONS WERE THEN SUMMED ALONG WITH THE CONCENTRATION OF BENZO(A)PYRENE ITSELF AND, FINALLY, MULTIPLIED BY THE CARCINOGENIC POTENCY FACTOR FOR BENZO(A)PYRENE. DETAILS OF THIS CALCULATION PROCESS ARE DESCRIBED IN THE ENDANGERMENT ASSESSMENT REPORT FOR BOWERS LANDFILL.

TABLE 5 (CONTINUED)
SUMMARY OF POTENTIALLY SIGNIFICANT RISKS IDENTIFIED FOR
BOWERS LANDFILL

EXPOSURE ROUTE	CONTAMINANTS	RISK ASSESSMENT
1. INGESTION OF GROUND WATER	BARIUM BENZENE	HAZARD INDEX(2)=1.04 INCREMENTAL CARCINOGENIC RISK=9X10(-6) (WORST CASE), 1X10(-6) (PROBABLE CASE)
2. INGESTION OF SURFACE WATER	PCBS	MAXIMUM PCB CONCENTRATION IN THE DRAINAGE DITCHES (2.6 UG/L) EXCEEDS THE AMBIENT WATER QUALITY CRITERION (AWQC) FOR CONSUMPTION OF DRINKING WATER. THIS AWQC (0.0013 UG/L) CORRESPONDS TO A 10(-6) CANCER RISK.
3. INGESTION OF AQUATIC ANIMALS	MERCURY	THE MAXIMUM MERCURY CONCENTRATION (0.2 UG/L) EXCEEDS THE AWQC BASED ON INGESTION OF AQUATIC ANIMALS (0.146 UG/L).
4. INGESTION OF SOILS	LEAD	HAZARD INDEX=3.20
	TOTAL PAHS(4)	INCREMENTAL CARCINOGENIC RISK=2X10(-6)
	PCBS	INCREMENTAL CARCINOGENIC RISK=7X10(-7)
5. DIRECT CONTACT WITH SURFACE WATER BY AQUATIC ANIMALS	MERCURY	MAXIMUM MERCURY CONCENTRATION (0.2 UG/L) EXCEEDS THE 4-DAY AWQC FOR PROTECTION OF AQUATIC LIFE (0.012 UG/L).

NOTES:

- 1 CA = CARCINOGENIC
NCA = NONCARCINOGENIC
- 2 THE HAZARD INDEX(HI) IS CALCULATED AS THE RATIO OF EXPOSURE
DOSE TO ACCEPTABLE DOSE; AN HI 1 INDICATES A POTENTIALLY SIGNIFICANT RISK.
- 3 US EPA GUIDANCE DESCRIBES A TARGET CARCINOGENIC RISK RANGE
OF 10^{-4} TO 10^{-7} . RISKS GREATER THAN 10^{-4} ARE CONSIDERED
"SIGNIFICANT", WHILE RISKS 10^{-7} ARE CONSIDERED INSIGNIFICANT
RISKS BETWEEN 10^{-4} AND 10^{-7} ARE WITHIN THE TARGET RANGE;
THEIR SIGNIFICANCE WILL, IN GENERAL, REFLECT SITE SPECIFIC FACTORS.
- 4 CALCULATIONS INCLUDED THE FOLLOWING CARCINOGENIC PAHS:
BENZO(A)ANTHRACENE, BENZO(A)PYRENE, BENZO(B)FLUORANTHENE,
CHRYSENE, DIBENZO(A,H)ANTHRACENE, AND INDENO(1,2,2-CD)PYRENE.
THE INCREMENTAL CARCINOGENIC RISK FOR TOTAL PAHS WAS CALCULATED
BY MULTIPLYING THE MAXIMUM CONCENTRATION OF EACH PAH OTHER THAN
BENZO(A)PYRENE BY A RELATIVE POTENCY FACTOR TO BENZO(A)PYRENE.
THE ADJUSTED CONCENTRATIONS WERE THEN SUMMED ALONG WITH THE
CONCENTRATION OF BENZO(A)PYRENE ITSELF AND, FINALLY, MULTIPLIED
BY THE CARCINOGENIC POTENCY FACTOR FOR BENZO(A)PYRENE. DETAILS
OF THIS CALCULATION PROCESS ARE DESCRIBED IN THE ENDANGERMENT
ASSESSMENT REPORT FOR BOWERS LANDFILL.

TABLE 5 (CONTINUED)

SUMMARY OF POTENTIALLY SIGNIFICANT RISKS IDENTIFIED FOR
BOWERS LANDFILL

EXPOSURE ROUTE	CONTAMINANTS	COMMENTS
1. INGESTION OF GROUND WATER	BARIUM	WHILE BASED ON THE MAXIMUM BARIUM CONCENTRATION, THE HAZARD INDEX ONLY SLIGHTLY EXCEEDS UNITY. THEREFORE, THE ACTUAL NONCARCINOGENIC RISK VIA THIS SCENARIO IS PROBABLY VERY SMALL.
	BENZENE	THE INCREMENTAL CARCINOGENIC RISK FOR BENZENE ARE WITHIN THE TARGET RANGE OF 10^{-4} TO 10^{-7} (SEE FOOTNOTE NO. 3).
2. INGESTION OF SURFACE WATER	PCBS	THE AWQC FOR PCBS ASSUMES LIFETIME EXPOSURE WHILE THIS SCENARIO ASSUMES INFREQUENT INCIDENTAL INGESTION; THEREFORE, THIS COMPARISON OVERESTIMATES THE ACTUAL RISK.
3. INGESTION OF AQUATIC ANIMALS	MERCURY	TISSUE SAMPLES HAVE NOT BEEN TAKEN TO VERIFY THE EXTENT OF THIS EXPOSURE. HOWEVER, AVERAGE MERCURY CONCENTRATIONS WERE BELOW THE AWQC AND MERCURY WAS FOUND IN ONLY ONE SURFACE WATER SAMPLE FROM THE SCIOTO RIVER. THUS, THIS RISK IS LIMITED.

4. INGESTION OF SOILS	LEAD	THIS HAZARD INDEX MAY OVERESTIMATE THE ACTUAL RISK BECAUSE IT ASSUMES BOTH THE MAXIMUM LEAD CONCENTRATION AND A WORST CASE SOIL INGESTION RATE. FURTHER, LEAD LEVELS IN ON-SITE SOILS ARE BELOW CENTERS FOR DISEASE CONTROL (CDC) GUIDELINES FOR RESIDENTIAL AREAS.
	TOTAL PAHS(4)	THESE TWO RISKS MAY OVERESTIMATE THE ACTUAL RISK BECAUSE THEY ARE BASED ON MAXIMUM CONCENTRATIONS AND A WORST CASE SOIL INGESTION RATE SEE ALSO FOOTNOTE NO. 3.
	PCBS	
5. DIRECT CONTACT WITH SURFACE WATER BY AQUATIC ANIMALS	MERCURY	ACTUAL RISK MAY BE NEGLIGIBLE BASED ON AVERAGE MERCURY CONCENTRATIONS. FURTHER MERCURY WAS FOUND IN ONLY ONE SURFACE WATER SAMPLE FROM THE SCIOTO RIVER.

NOTES:

- 1 CA = CARCINOGENIC
NCA = NONCARCINOGENIC
- 2 THE HAZARD INDEX(HI) IS CALCULATED AS THE RATIO OF EXPOSURE DOSE TO ACCEPTABLE DOSE; AN HI 1 INDICATES A POTENTIALLY SIGNIFICANT RISK.
- 3 US EPA GUIDANCE DESCRIBES A TARGET CARCINOGENIC RISK RANGE OF $10(-4)$ TO $10(-7)$. RISKS GREATER THAN $10(-4)$ ARE CONSIDERED "SIGNIFICANT", WHILE RISKS $10(-7)$ ARE CONSIDERED INSIGNIFICANT RISKS BETWEEN $10(-4)$ AND $10(-7)$ ARE WITHIN THE TARGET RANGE; THEIR SIGNIFICANCE WILL, IN GENERAL, REFLECT SITE SPECIFIC FACTORS.
- 4 CALCULATIONS INCLUDED THE FOLLOWING CARCINOGENIC PAHS:
BENZO(A)ANTHRACENE, BENZO(A)PYRENE, BENZO(B)FLUORANTHENE, CHRYSENE, DIBENZO(A,H)ANTHRACENE, AND INDENO(1,2,2-CD)PYRENE. THE INCREMENTAL CARCINOGENIC RISK FOR TOTAL PAHS WAS CALCULATED BY MULTIPLYING THE MAXIMUM CONCENTRATION OF EACH PAH OTHER THAN BENZO(A)PYRENE BY A RELATIVE POTENCY FACTOR TO BENZO(A)PYRENE. THE ADJUSTED CONCENTRATIONS WERE THEN SUMMED ALONG WITH THE CONCENTRATION OF BENZO(A)PYRENE ITSELF AND, FINALLY, MULTIPLIED BY THE CARCINOGENIC POTENCY FACTOR FOR BENZO(A)PYRENE. DETAILS OF THIS CALCULATION PROCESS ARE DESCRIBED IN THE ENDANGERMENT ASSESSMENT REPORT FOR BOWERS LANDFILL.

TABLE 6

SUMMARY OF WATER QUALITY SAMPLING RESULTS FOR THE CITY OF
CIRCLEVILLE DEPARTMENT OF PUBLIC UTILITIES, WATER SUPPLY SYSTEM
1980-1987 (CONCENTRATIONS OF INDICATOR CHEMICALS IN UG/L)

LOCATION:	114 W. FRANKLIN	#1 WELL	#2 WELL	#3 WELL
DATES:	08/24/87	06/19/86	06/19/86	06/19/86
COMPOUND				
BARIUM	160	300	300	300
LEAD	1	ND	5	5
MERCURY	0.2	0.5	0.5	0.5
CHLORDANE	-	-	-	-
PCBS	-	-	-	-
TETRACHLOROETHENE (B)	-	-	-	-
PAHS	-	-	-	-

NOTES:

COMPILED FROM RESULTS SUBMITTED TO OHIO DEPARTMENT OF HEALTH, 1980-1987.

- A ONLY THE RESULT FOR SAMPLES THAT WERE ANALYZED FOR AT LEAST 1
INDICATOR CHEMICAL OTHER THAN TETRACHLOROETHENE ARE PRESENTED.
SEE FOOTNOTE B.
- B 34 ADDITIONAL SAMPLES WITHIN THIS TIME PERIOD WERE ANALYZED FOR
TETRACHLOROETHENE; ALL THE RESULTS WERE NEGATIVE.
- ND COMPOUND WAS ANALYZED FOR BUT NOT DETECTED.
- COMPOUND WAS NOT MEASURED.

TABLE 6 (CONTINUED)

SUMMARY OF WATER QUALITY SAMPLING RESULTS FOR THE CITY OF
CIRCLEVILLE DEPARTMENT OF PUBLIC UTILITIES, WATER SUPPLY SYSTEM
1980-1987 (CONCENTRATIONS OF INDICATOR CHEMICALS IN UG/L)

LOCATION:	WELLS 1, 2 AND 3	663 HASSLE RD.
DATES:	12/05/85	04/27/83
COMPOUND		
BARIUM	300	-
LEAD	5	-
MERCURY	0.5	-
CHLORDANE	-	ND
PCBS	-	ND
TETRACHLOROETHENE (B)	-	0.5
PAHS	-	ND

NOTES:

COMPILED FROM RESULTS SUBMITTED TO OHIO DEPARTMENT OF HEALTH, 1980-1987.

- A ONLY THE RESULT FOR SAMPLES THAT WERE ANALYZED FOR AT LEAST 1 INDICATOR CHEMICAL OTHER THAN TETRACHLOROETHENE ARE PRESENTED. SEE FOOTNOTE B.
- B 34 ADDITIONAL SAMPLES WITHIN THIS TIME PERIOD WERE ANALYZED FOR TETRACHLOROETHENE; ALL THE RESULTS WERE NEGATIVE.
- ND COMPOUND WAS ANALYZED FOR BUT NOT DETECTED.
- COMPOUND WAS NOT MEASURED.